

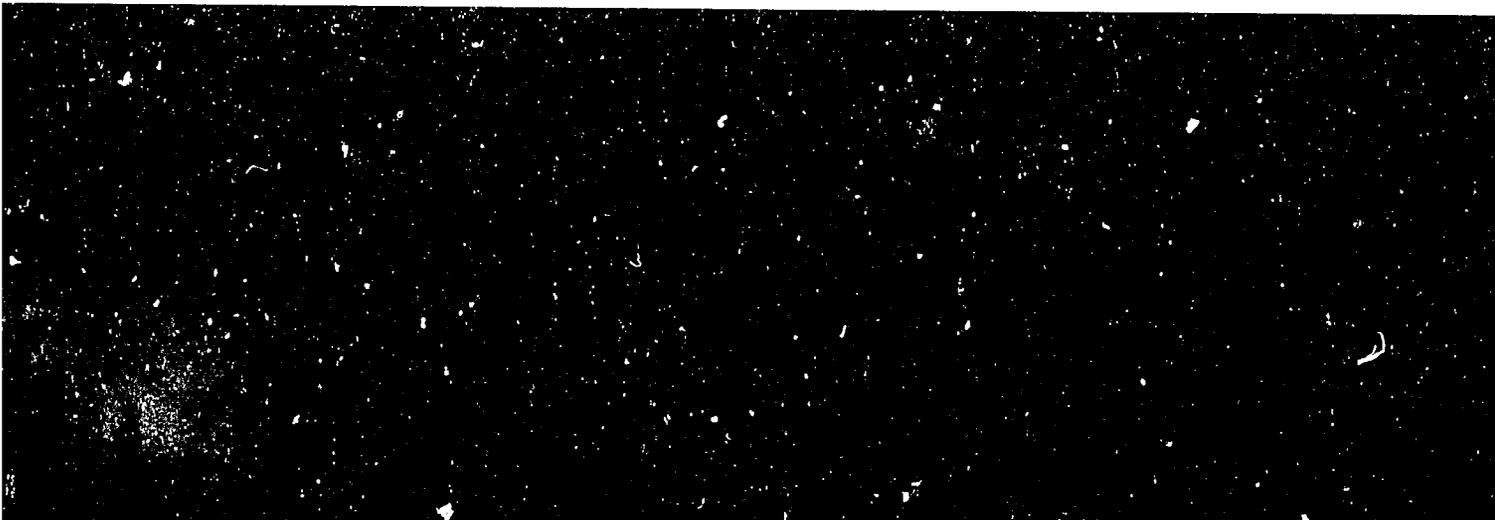
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4/2/91



# XIV IVACG Meeting

18-21 June 1991  
Guayaquil, Ecuador

INTERNATIONAL VITAMIN A CONSULTATIVE GROUP (IVACG)<sup>®</sup>



# **XIV IVACG Meeting**

18–21 June 1991  
Guayaquil, Ecuador



The purpose of the International Vitamin A Consultative Group (IVACG)<sup>®</sup> is to guide international activities aimed at reducing vitamin A deficiency in the world. The group offers consultation and guidance to various operating and donor agencies that are seeking to reduce vitamin A deficiency and its accompanying blindness. As part of this service, IVACG has prepared guidelines and recommendations for

- ▲ Assessing the regional distribution and magnitude of vitamin A deficiency;
- ▲ Developing intervention strategies and methodologies to control vitamin A deficiency;
- ▲ Evaluating the effectiveness of implemented programs on a continuing basis; and
- ▲ Research needed to support the assessment, intervention, and evaluation of programs.

These guidelines and recommendations are available through IVACG's publications program. A list of publications available from IVACG, along with ordering information, is given on the inside back cover of this meeting summary.

The publication of this meeting summary is made possible by support from the Office of Nutrition, Bureau for Research and Development, U.S. Agency for International Development, under Cooperative Agreement No. DAN-5115-A-00-7114-00 with The Nutrition Foundation, Inc., Washington, D.C.

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## **INTRODUCTION**

The International Vitamin A Consultative Group (IVACG) is an organization dedicated to reducing the prevalence of vitamin A deficiency worldwide. Established in 1975 with support from the U.S. Agency for International Development, IVACG continues to analyze issues related to the etiology, treatment, and prevention of vitamin A deficiency. IVACG activities involve scientists, programmers, and policy makers throughout the world who are working to prevent this nutritional deficiency.

The XIV IVACG Meeting was held in Guayaquil, Ecuador, 18 to 21 June 1991. The meeting, co-hosted by a local committee and IVACG, brought together 193 individuals from 39 countries. These experts in health, nutrition, biochemistry, agriculture, horticulture, education, and development presented and discussed current research related to community-based interventions and new research findings related to the assessment of vitamin A status and the effect of vitamin A on morbidity and mortality.

The program included 85 oral, poster, and video presentations that illustrated elements critical to successful interventions for prevention of vitamin A deficiency. To provide an opportunity for many organizations to report on their programs, presenters focused on major highlights of each program. In addition to presentations, colleagues shared their perspectives and gained practical insights into these complex issues during evening sessions led by experts from several disciplines as well as during discussion periods and social events.

This report attempts to convey much of the factual material presented and some of the discussion that followed. Those of us involved in its preparation hope that it will contribute to the global eradication of vitamin A deficiency by encouraging both increased community involvement in the choice and implementation of vitamin A programs and the application of new knowledge and better assessment methods.

**PROGRAM**

**XIV IVACG Meeting**



## Program Overview XIV IVACG Meeting

### Monday, 17 June 1991

1900 Early Registration

### Tuesday, 18 June 1991

0800 Registration

0900 Inauguration

1045 Invited Keynote Presentations

1400 Community-Based Interventions: Participation Issues

1555 Community-Based Interventions: Management Issues

1830 Reception

### Wednesday, 19 June 1991

0900 Community-Based Interventions: Availability and Consumption Issues

1110 Community-Based Interventions: Information, Education, and Communication Issues

1400 Community-Based Interventions: Information, Education, and Communication Issues (continued)

1535 Perspectives on Vitamin A Fortification

1640 Ecuador Poster Session/Video-viewing room open

### Thursday, 20 June 1991

0900 Vitamin A and Childhood Morbidity and Mortality: Reports from Clinical Trials

1120 Vitamin A and Childhood Morbidity and Mortality: Related Reports

1400 Update on Assessment Techniques

1555 Update on Assessment Techniques (continued)

1700 Meeting Themes Poster Session

1930 Concurrent Special Sessions on XIV IVACG Meeting Themes

**Friday, 21 June 1991**

- |      |   |
|------|---|
| 0900 | Nongovernmental Organization Presentations  |
| 1050 | Agency Presentations                        |
| 1400 | Country Updates and Programs Poster Session |
| 1500 | Agency Presentations (continued)            |
| 1630 | Closing Remarks                             |
| 1830 | Chevère en Chiva                            |

## Program XIV IVACG Meeting

### Monday, 17 June 1991

0900-1200 IVACG Steering Committee meeting

1900-2200 **Early Registration**

### Tuesday, 18 June 1991

0800 **Registration**

0900 **Inauguration**

Mistress of Ceremonies:

Dr. Wilma B. Freire, Chairperson, Local Committee for the XIV IVACG Meeting  
and Director of Nutrition, CONADE, Ecuador

Dr. Omar Dary, Pan American Health Organization

Mr. E. Gonzales-Regueira, Food and Agriculture Organization of the United Nations

Mr. Robert Kramer, Deputy Director, US Agency for International Development,  
Mission to Ecuador

Dr. Norge W. Jerome, Director, Office of Nutrition, Bureau for Science and  
Technology, US Agency for International Development

Econ. Jose-Carlos Cuentas-Zavala, UNICEF Representative, Ecuador

Dr. Plutarco Naranjo, Minister of Health, Ecuador

Dr. Abraham Horwitz, IVACG Chairman

1030 **Break**

1045 **Invited Keynote Presentations**

Chairperson: Dr. Abraham Horwitz

1045 **Essential Components of Successful Community-Based Development Programs**  
Dr. Urban Jonsson

1115 **Community-Based Interventions for Vitamin A Deficiency**  
Dr. Barbara A. Underwood

1145 **Evaluation of the Vitamin A Status of Ecuador and Programmatic Implications**  
Dr. Wilma B. Freire

1215 **Lunch**

- 1400      **Community-Based Interventions for Control of Vitamin A Deficiency:  
Participation Issues**  
Chairperson: Mrs. Alawia El Amin
- 1400      Community Participation in Addressing Health Problems: A Case Study  
Dr. Marcelo Moreano B.
- 1415      Control of Nutritional Blindness In Children Through Community Participation  
Dr. Gopa Kothari
- 1430      The Caruaru Vitamin A Program: Has It Been Sustainable?  
Dr. Hernando Flores
- 1445      Child Characteristics That Influence Voluntary Participation in a Vitamin A  
Distribution Program  
Dr. J.R. Cruz
- 1500      Intrahousehold Food Distribution - An Anthropological Approach  
Dr. E. Saenz de Tejada
- 1515      Discussion
- 1535      Break
- 1555      **Community-Based Interventions: Management Issues**  
Chairperson: Dr. Jose Mora
- 1555      Management Concepts and Issues for the Prevention of Nutritional Blindness  
Through Efficient/Effective Planning and Evaluation of Community-Based Vitamin A  
Programs in Developing Nations  
Mr. John Barrows
- 1610      Distribution of Vitamin A Capsules in Disaster Prone Areas of Bangladesh  
Dr. Martin W. Bloem
- 1625      Use of a Daily Illness Diary in Improving Morbidity Surveillance Data Within a Field  
Trial of Vitamin A Supplementation in Northern Ghana  
Dr. Paul Arthur
- 1640      Training, The Key to Success in Home Gardening Program  
Dr. Y.H. Yang
- 1655      Discussion, summary, and announcements
- 1730      (end of day's formal sessions)
- 1830      Poolside reception finishing at 2000  
Host: Ecuaroche

Wednesday, 19 June 1991

- 0900        **Community-Based Interventions: Availability and Consumption Issues**  
              Chairperson: Dr. Franz Simmersbach
- 0900        The Saga of Including Carotene-Rich Foods in Children's Diets  
              Dr. Saranya Reddy
- 0915        Horticultural Intervention for Improving Vitamin A Status  
              Dr. Vinodini Reddy
- 0930        Patterns of Availability, Acceptance, and Use of Carotene-Containing,  
              Domesticated Vegetables, and Wild Plants in Three Rural Regions of Guatemala  
              (Alta Verapaz, Santa Rosa, Zacapa)  
              Mr. William Scott
- 0945        Home Gardening and Consumption Promotion Aimed at Combatting Vitamin A  
              Deficiency in Bangladesh  
              Mr. Aminuzzaman Talukder
- 1000        Effects of Carotenoid-Rich Local Diets, Dietary Fat Intake, and Deworming on  
              Vitamin A Status of Preschool Children  
              Dr. Michael Latham presenting for Dr. Fasli Jalal
- 1015        Discussion
- 1050        Break
- 1110        **Community-Based Interventions: Information, Education, and Communication  
              Issues**  
              Chairperson: Dr. Chet Pant
- 1110        Assessment of Alternative Communication Interventions for Vitamin A  
              Ms. Judi Aubel
- 1125        Integration of Vitamin A Supplementation and Nutrition Education into Community  
              Health Services: A Case Study  
              Mr. Rolf Klemm
- 1140        A Pictorial Questionnaire on Vitamin A for Tarahumara Indian Children in Rural  
              Mexico  
              Ms. Sandra Van Den Berg
- 1155        Determinants of Household and Preschooler Vitamin A Consumption in  
              Southwestern Kenya  
              Dr. Eileen Kennedy
- 1210        Discussion and announcements
- 1230        Lunch and set up time for Ecuador poster session

- 1400      **Community-Based Interventions: Information, Education, and Communication Issues (continued)**  
Chairperson: Dr. Sakorn Dhanamitta
- 1400      The Impact of Social Marketing Efforts on Megadose Vitamin A Capsule Coverage Rates: Results of a Pilot Project in Central Java  
Dr. Benny A. Kodyat
- 1415      Social Marketing of Vitamin A-Rich Foods  
Ms. Suttalak Smitasiri
- 1430      Social Marketing to Promote Vitamin A Awareness, Consumption, and Capsule Distribution in Bangladesh  
Mr. Mir Mahboob Ali
- 1445      Control of Vitamin A Deficiency in Primary School Children Through Motivation Communications and Integrated Farming in Nongkhal Province  
Mr. Richard W. Renas
- 1500      Break
- 1515      Summary of Community-Based Interventions  
Dr. Alfred Sommer
- 1535      **Perspectives on Vitamin A Fortification**  
Chairperson: Prof. Michael Latham
- 1535      Fortification: The Most-Promising, Most-Ignored Intervention to Control Vitamin A Deficiency  
Prof. Michael Latham
- 1550      Update on Control of Vitamin A Deficiency in Latin America Through Sugar Fortification  
Dr. Omar Dary
- 1605      Fortification of Monosodium Glutamate in Indonesia  
Mr. Steve E. Wilbur
- 1620      Discussion
- 1640      **Ecuador Poster Session**
- 1640      **Video-viewing room open**
- 1800      (end of day's formal sessions)
- 1830      IVACG Steering Committee meeting
- 1930      IVACG Steering Committee meeting with IVACG Regional Representatives for Africa

Thursday, 20 June 1991

- 0900        **Vitamin A and Childhood Morbidity and Mortality: Reports from Clinical Trials**  
              Chairperson: Dr. Abraham Horwitz
- 0900        Vitamin A Supplementation of Asymptomatic Children, Effects on Morbidity and  
              Mortality: The Sudan Experience  
              Dr. M.G. Herrera
- 0915        Reduction of Preschool Child Mortality by Vitamin A in Nepal: A Randomized,  
              Double-masked Community Trial  
              Dr. Keith P. West, Jr.
- 0930        Effect of a Single High Dose of Vitamin A on Mortality in a Nepalese Population  
              with High Childhood Mortality and Xerophthalmia Rates  
              Dr. Nils M.P. Daulaire
- 0945        Vitamin A Status In Young Children in the Upper East Region of Ghana: Baseline  
              Characteristics, Ghana VAST  
              Dr. Fred Binka
- 1000        Morbidity Consequences of Measles Treated with Vitamin A or Placebo In Young  
              African Children  
              Mrs. Anna Coutsoudis
- 1015        Break
- 1035        Discussion
- 1120        **Vitamin A and Childhood Morbidity and Mortality: Related Reports**  
              Chairperson: Dr. Vinodini Reddy
- 1120        Immune Status in Children with Mild Vitamin A Deficiency in Indonesia  
              Dr. Richard Semba
- 1135        Effect of Supplementation on Vitamin A and Zinc Nutriture of Children in Northeast  
              Thailand  
              Dr. Emorn Udomkesmalee
- 1150        Discussion and announcements
- 1225        Lunch and set up time for meeting themes poster session
- 1400        **Update on Assessment Techniques**  
              Chairperson: Dr. Jesus Bulux
- 1400        Introduction and Overview of Assessment Techniques  
              Dr. James A. Olson
- 1415        Assessment of Marginal Vitamin A Status by Use of the Modified Relative Dose  
              Response (MRDR) Assay  
              Ms. Sherry Tanumihardjo

- 1430      **Prevalence of Inadequate Vitamin A Nutriture in Preschool Children of the North and Northeast Thailand**  
            **Dr. Sangsom Sinawat**
- 1445      **The Validity of a Pictorial Checklist Used by Community-Level Health Workers to Estimate 7-Day Vitamin A Intake of Weaned Preschool-Age Children in Guatemala**  
            **Ms. V.M. Krause**
- 1500      **Combined 24-Hour Recall and Food Frequency Survey in Assuring Vitamin A Intake Among Preschool Children: The Case of Haiti**  
            **Dr. Mohamed Mansour**
- 1515      **Discussion**
- 1535      **Break**
- 1555      **Update on Assessment Techniques**  
            **Chairperson: Dr. Mohamed Mansour**
- 1555      **Back to Basics: A Low Budget Approach to Vitamin A Problem Assessment and Program Planning**  
            **Mr. David S. Rosen**
- 1610      **Beneficial Effects of Vitamin A Supplements in Undernourished Pregnant Women**  
            **Dr. B. Sivakumar**
- 1625      **Discussion and announcements**
- 1645      **IVACG Assessment Methodology Task Force Report**  
            **Dr. James A. Olson**
- 1700      **Meeting Themes Poster Session**
- 1830      **(end of formal sessions for the day)**
- 1930-2100 **Concurrent Special Sessions on XIV IVACG Meeting Themes**
- Community-Based Interventions**  
            **Chairperson: Dr. Festo Kavishe**
- Vitamin A Status and Childhood Morbidity and Mortality**  
            **Chairperson: Dr. Jose Martines**
- Assessment Techniques**  
            **Chairperson: Dr. Clive West**

Friday, 21 June 1991

- 0900           **Nongovernmental Organization Presentations**  
                  Chairperson: Ms. Susan Eastman
- 0900           Vitamin A in the Community: A PVO Perspective  
                  Ms. Anne L. Ralte, VITAP, Helen Keller International
- 0915           Critical Elements in Successful Community-Based Vitamin A Programming  
                  Dr. Fe Garcia, World Vision Relief and Development, Inc.
- 0930           Sight Savers  
                  Dr. Gopa Kothari
- 0945           International Eye Foundation  
                  Mr. John Barrows
- 1000           Christoffel Blindenmission  
                  Dr. Clare Gilbert
- 1015           Discussion
- 1025           Official photo
- 1035           Break
- 1050           **Agency Presentations**  
                  Chairperson: Dr. J. Peter Greaves
- 1050           PAHO: Programs to Control Vitamin A Deficiency in the Americas  
                  Dr. Manuel Pena
- 1105           FAO: Communications Projects for Control of Vitamin A Deficiency  
                  Dr. Franz Simmersbach
- 1120           AID: Vitamin A Programs of the AID Office of Nutrition  
                  Dr. Frances R. Davidson
- 1135           WHO: Integration of Vitamin A Distribution with Immunization Programs  
                  Dr. Nicholas Cohen
- 1150           Discussion
- 1210           Lunch and set up time for country updates and programs poster session
- 1400           **Country Updates and Programs Poster Session**

- 1500      **Agency Presentations (continued)**  
            Chairperson: Dr. C.O. Chichester
- 1500      **WHO: Vitamin A Regional Network for Asia**  
            Dr. J. Michael Gurney
- 1515      **UNICEF: World Summit for Children Initiatives for Control of Vitamin A Deficiency**  
            Dr. J. Peter Greaves
- 1530      **Report on a Joint Consultation on Intervention Trials**  
            Dr. Frances R. Davidson
- 1545      **Squamous Metaplasia in the Respiratory Epithelium of Children Who Died of  
Pneumonia**  
            Dr. Normando C. Gonzaga
- 1600      **Discussion**
- 1620      **IVACG Secretariat Report**  
            Ms. Laurie Lindsay Aomari
- 1630      **Closing Remarks**  
            Dr. Abraham Horwitz
- 1645      **(end of formal sessions)**
- 1830      **Dinner and Closing Celebrations: Chevère en Chiva**  
            Host: Atlantic Industries, Ltd.

## Poster Sessions and Video Presentations

Wednesday, 19 June 1991

1640 **Ecuador Poster Session**

PROANDES, Chapter Esmeraldas: Urban and Rural Services Project  
Ms. Anna Delgado, UNICEF, Ecuador

Self Community Management for Urban Projects: Community "La  
Ecuadoriana," Quito  
Dr. Fabian Recalde

1640 **Video Presentations**

*The Caruaru Vitamin A Program*  
Dr. Hernando Flores

*The Impact of Social Marketing to Promote Vitamin A Awareness,  
Consumption and Capsule Distribution in Bangladesh*  
Mr. Mir Mahboob Ali

*The Battle Against Nutritional Blindness* (In Spanish or English.)  
Dr. John Gmunder

*Vitamin A Research Group* (Institute of Nutrition, Federal University of Rio de  
Janeiro)  
Dr. Hernando Flores

*Comuniquemonos Ya* (Spanish language training video on counseling in  
growth promotion programs.)  
Ms. Valerie Uccellani

*Citologia de Impresion Conjuntival*  
Ms. Liliana Clement

Thursday, 20 June 1991

1700 **Meeting Themes Poster Session**

**Community-Based Interventions Posters**

An Approach to Community Based Research  
Dr. Laxmi Rahmathullah

How "Long Term" Intervention is Nutrition Education: Characteristics and  
Determinants of Program Coverage in Rural Nepal  
Dr. Chet Raj Pant

**Assessment Posters**

Intake of Dietary Vitamin A by Rural Urban Guatemalan Preschool Children:  
Patterns of Consumption of Retinol and Provitamin A Sources  
Ms. J. Quan de Serrano

Conjunctival Impression Cytology: Field Experience and Preliminary Results  
in a Large-scale Vitamin A Supplementation Trial in Ghana  
Dr. David A. Ross

**Morbidity and Mortality Posters**

Effect of a Single Oral Dose of Vitamin A (200,000 IU) on Diarrheal and  
Respiratory Morbidity Among Preschoolers of Rural Guatemala  
Dr. J.R. Cruz

Impact of Vitamin A Supplementation on Diarrhoea and Acute Respiratory  
Infection in Children  
Dr. Mauricio Lima Barreto

Effect of Vitamin A Depletion and Repletion on Secondary Immune Response  
to Protein Antigen: Tetanus Toxoid  
Dr. Makiko Kinoshita

Vitamin A and Immune Function  
Dr. C.E. West

Enhanced T-Lymphocyte Blastogenic Response to Tuberculin in Children of  
Northeast Thailand Supplemented with Vitamin A and Zinc  
Dr. Emorn Udomkesmalee presenting for Dr. T.R. Kramer

Friday, 21 June 1991

1400 **Country Updates and Programs Poster Session**

Vitamin A Status of Children in Belize, C.A.  
Dr. Dhiren Makdani

The Vitamin A Status of Young Children in the Upper East Region of Ghana  
Dr. Fred N. Binka

Vitamin A Deficiency in Ethiopia  
Mr. Zewdie Wolde Gebriel

Study on Vitamin A Deficiency in Ethiopia, A Country Affected by Recurrent  
Drought and Famine  
Dr. Marina Repola

**Vitamin A Deficiency in Kiribati**  
**Mr. Robert Gern**

**Vitamin A Status in Urban Slums of Karachi**  
**Dr. Ayesha Molla**

**Vitamin A Deficiency in the Sudan**  
**Mrs. Alawia El Amin**

**Prevention and Control of Vitamin A Deficiency: The Tanzania Experience**  
**Mr. C.R. Temalilwa**

**SUMMARY**  
**XIV IVACG Meeting**



## OPENING SESSION

The XIV Meeting of the International Vitamin A Consultative Group (IVACG) was inaugurated by several distinguished speakers on behalf of the Government of Ecuador (1),\* the Pan American Health Organization (PAHO) (2), the United States Agency for International Development (USAID) (3, 4), the United Nations Children's Fund (UNICEF) (5), the Food and Agriculture Organization of the United Nations (FAO) (6), and IVACG (7). Together, these agencies have played pivotal roles in attracting and committing resources and leading global efforts to control vitamin A deficiency as a public health problem.

From their unique perspectives, the speakers addressed the major theme of the meeting: prevention of vitamin A deficiency and its morbid consequences through community-based interventions. A consistent theme concerned the need to combat vitamin A deficiency within the context of the social, economic, dietary, and health needs and resources of a population. His Excellency, Dr. Plutarco Naranjo, the Minister of Health of Ecuador, cast vitamin A deficiency as one of several important forms of malnutrition that afflict children and mothers in Ecuador (1). Speakers emphasized the need to recognize vitamin A deficiency as a nutritional problem rooted in the community, and they argued for solutions that are effective, practical, and sustainable, and that are to be accomplished through full investment in human resources (2-6), particularly in the "poor majority" (3). Formation of institutional linkages across public and private sectors that would strengthen nutritional priorities and tie them into economic development was offered as a vital step toward long-term control of vitamin A deficiency (4).

The inaugural session ended with the tone for the meeting being set by the IVACG Chairperson, Dr. Abraham Horwitz (7): vitamin A deficiency is a complex but preventable nutritional problem, as reflected by the diverse array of dietary solutions available to the community. The setting and time is right for examination and debate

\* Numbers in parentheses refer to presentations at the meeting. These presentations are listed at the end of this meeting summary.

aimed to provide new insights into the causes and consequences of vitamin A deficiency, methods to assess vitamin A deficiency, and the means available at the national and community levels for its control. Preventing vitamin A deficiency represents a clear step toward protecting our most precious current and future resource--our children.

## **INVITED KEYNOTE PRESENTATIONS**

Three keynote speakers offered their insights on how community programs develop (8) and how community-based vitamin A interventions may be part of that development process, both generically (9) and within the context of the meeting's host country, Ecuador (10).

### **Essential Components of Successful Community-Based Development Programs**

In his address, Dr. Urban Jonsson (8) articulated the dynamics of a "new development paradigm" that is emerging and is based on two key changes that have occurred in developmental thinking: (1) a changing view of the role of poor people in eradicating their own poverty, and (2) a much stronger international emphasis on normative and moral arguments for human rights. In this "movement" poor people are regarded as key actors (not passive recipients), with their complex but resource-efficient survival and coping strategies better recognized, understood, and appreciated for what they are--adaptive processes in a continuously changing environment. Strengthening these coping and survival strategies requires empowerment of poor people; that is, increased human, economic, organizational, and managerial resources for the poor. Improved health and nutrition are important elements of these resources. The poor are empowered when the community actively participates in setting priorities, and in planning, implementing (controlling resources), monitoring, and evaluating their own development. Sustainability is enhanced when the community owns and controls its share of development resources.

Thus far lessons have shown that successful, community-based programs have a strong element of advocacy; the problems must be appreciated, understood, and

given priority at all political levels in order for solutions to be developed and sustained. New resources are created, and old resources are reoriented toward assessing and resolving problems. The process should be flexible, permitting communities to adjust their priorities according to their perceived needs. Successful programs fit into and complement existing community organizations, infrastructure, and ongoing strategies, including those at the national level. The process may be as important as the outcome. Early, visible impact earns credibility. Sustainable programs should be affordable. Dr. Jonsson summarized, as a model community-based nutrition program, the well-known "Iringa Project" in Tanzania that, over the course of the past decade, has embodied many of these concepts; this project has greatly reduced childhood malnutrition and has now expanded to other regions of Tanzania, with plans to cover the whole country. A cyclical "Triple A" approach emerged from the Iringa Project that is finding use in other countries; this approach includes assessment of the problem, analysis of the causes of the problem, and action based on the analytic findings. The level of action must be in line with available resources.

### **Community-Based Interventions for Vitamin A Deficiency**

Applying the above concepts to the themes of the meeting, Dr. Barbara Underwood (9) depicted a "deprivation syndrome" with attendant social, ecologic, and economic stresses that characterize the poor in the developing world. Malnutrition, including chronic dietary vitamin A deficiency, infection, and a high risk of death among children, is often a consequence. Long-term, community-based dietary solutions to prevent vitamin A deficiency must recognize existing constraints and utilize local resources.

The GOBI initiative of UNICEF (i.e., growth monitoring, oral rehydration, breastfeeding, and immunization) may provide one framework for where and how interventions can be added to existing strategies to improve vitamin A status; thus, "Ga-Oa-Ba-la" suggests that vitamin A nutrition may be best served by incorporation of measures to improve vitamin A nutrition wherever GOBI efforts are underway. This type of collaboration may be preferable to declaring a new, separate initiative (e.g., GOBIA). Other ongoing programs within communities may offer additional

opportunities, such as income-generating projects, literacy programs, and family planning efforts, particularly those involving women.

Options for improving vitamin A nutriture in a high-risk population, however, extend well beyond the GOBI approach. There may be opportunities in the community to increase awareness of the problem (i.e., advocacy), to develop and disseminate local nutrition messages, to provide supplements for children, to fortify foods, or to develop horticultural, public health, and socioeconomic programs. None of these options are mutually exclusive; most are likely to be complementary. However, Dr. Underwood underscored four key elements of a strategy for sustainable prevention of any vitamin A deficiency: (1) community awareness of the problem and the possible solutions; (2) choice by the community of the available options; (3) community empowerment, which must occur during this process for it to be sustained; and (4) enhanced public demand for the products of intervention (thus making a strategy sustainable). The diverse approaches available for preventing vitamin A deficiency suggests that, if linked to community development, control may be achievable by the year 2000 and sustainable beyond that point.

### **Evaluation of the Vitamin A Status of Ecuador and Programmatic Implications**

The third keynote speaker, Dr. Wilma Freire (10), introduced delegates to the problem of vitamin A deficiency in Ecuador. This country has a national plan to define the extent and severity of vitamin A deficiency by region, by specific risk factors, and by resources. These data will help in the design and implementation of a preventive strategy that conforms to the health priorities of the country. In 1986 a national survey of preschool children demonstrated a prevalence of biochemical vitamin A deficiency ( $<20 \mu\text{g}/\text{dL}$  of serum) of 14.1% (SE=1.1%), with a higher prevalence observed in rural (16.4%) than urban (11.9%) areas. Dietary intakes are also lower in rural areas; nationally, ~33% of preschool children consume diets that provide  $<25\%$  of the recommended vitamin A intake levels (based on Instituto de Nutricion de Centro America y Panama (INCAP) recommendations). This figure reaches 63% in rural highlands. These data suggest that mild-to-moderate vitamin A deficiency exists in Ecuador and may be most severe in rural highland communities. Plans are underway to include vitamin A assessment in a new national

surveillance system and to direct nutrition education to high-risk groups identified by dietary findings.

## **COMMUNITY-BASED INTERVENTIONS FOR THE CONTROL OF VITAMIN A DEFICIENCY**

Papers on community-based vitamin A interventions were presented in four sessions spanning two days. The sessions covered participation; management; availability and consumption; and information, education, and communication. The breadth and diversity of topics presented were a reflection of the many options that exist to improve vitamin A intake in the community. Most papers in this session dealt with interventions seeking to increase the availability and consumption of local vitamin A-containing food sources or with delivery of large doses of vitamin A. A later session addressed fortification of foods with vitamin A.

### **Participation Issues**

Community participation leads its members to invest in projects that they perceive as useful. This was evident in Chilibulo, Ecuador, where residents themselves worked to define a "causal model" for childhood malnutrition based on apparent poor nutrient intakes and perceived illnesses of children. Villagers then set out to solve the problems of malnutrition by use of this model (11). In the slums of Bombay, local folk artists became involved in communicating messages on breastfeeding, preparation of weaning foods, "tin pot-roof top" gardening, use of oral rehydration therapy, etc. Communities visited by the artists became more aware of health and diet and demanded more health services than communities served by regular health workers. Being close to the social and cultural norms of the community, folk art can influence health-seeking behavior and participation in the community (12). Anthropologic observation can offer insight to the culture (including folk beliefs), environment, and socioeconomic factors that affect acceptance of a program. In Guatemala these techniques were applied to increase understanding of food availability and intrahousehold consumption patterns before introduction of a locally marketed, vitamin A-fortified gruel (13).

Innovative approaches are equally needed to encourage participation in vitamin A supplementation programs. In Caruaru, a city in northeast Brazil (14), it was found that local political support, visible economic aid from local businesses, a general sense of satisfaction of mothers about the program, and low-key technical support appeared to be the correct mix of factors to maintain a high rate of administration of vitamin A capsules (200,000 IU) to preschool-age children. After 18 months of implementation (four delivery rounds), serum vitamin A levels of  $<20 \mu\text{g/dL}$  had disappeared, rates of anemia and protein malnutrition had decreased, and there was a decreasing trend in child mortality.

Perception of benefit appeared to influence participation in a rural community in the highlands of Guatemala, where health messages promoted the potential benefit of vitamin A in fighting infection. Capsule acceptance in a single distribution round was greater among children with a previous history of diarrhea than among those without such a history (15).

### **Management Issues**

One approach to program management emphasized the importance of careful definition of problems (e.g., xerophthalmia in terms of prevalence, severity, highest risk groups, etc.); assessing available resources; developing quantifiable objectives; and systematically planning, implementing, and evaluating an intervention (16). Teaching and training in practical aspects of growing vegetables and fruits as well as involving national and local leaders, project personnel, and local villagers were considered essential to a successful home-garden program (17). Later reports on gardening also emphasized the need for training that builds upon local resources (23).

The value of a standardized, nutritional surveillance network to monitor delivery and impact of services was reported from Bangladesh. Here the rate of night blindness in the population was inversely related to the proportion of the population given vitamin A capsules on a regular basis (18). The value of having the "proper tools" for surveillance extended to assessment of outcomes in illiterate populations. Thus, the usefulness of a daily, pictorial child-illness diary, kept by mothers and submitted each week to a health care worker, is being tested in northern Ghana (19). Pictorial tools

to assess dietary vitamin A intake are also under development in rural Mexico (32) and Guatemala (50), as discussed below.

### **Availability and Consumption Issues**

Programs to prevent vitamin A deficiency must make vitamin A- or carotene-rich foods more available and must successfully promote their consumption by high-risk populations. In subsistence and mixed economies, improved gardening may offer the most appropriate way to increase availability and income. Before launching a gardening program, it is important to know the current mix and use of local foods. A Guatemalan project first identified domesticated and wild plants that could be introduced into garden projects in three types of communities: municipalities, villages/farms, and sparsely populated areas (20). As might be expected, dependence on wild and gathered plants was greater in sparsely populated areas than in more densely populated villages and towns. It was emphasized that gardening efforts may fail without local political support, or if the community perceives that the newly introduced plants are not of local origin, if there is lack of motivation, or if the garden program cannot be self-sustained.

In India, the vegetables most often in markets (21) and in homes (22) are poor sources of carotenes. Surveys of villages in three agroclimatic zones in the State of Andhra Pradesh found that only ~12% of all households grew dark-green leafy vegetables (DGLV) at home, citing (perceptions of) lack of space, water, and motivation, as well as destruction by goats, poultry, and pests as major reasons for not growing these foods (21). Preschool children reportedly ate carotene-rich foods (e.g., DGLV) once every seven to 14 days. On the basis of this profile, the National Institute of Nutrition in Hyderabad has launched a pilot horticulture-plus-education program in 20 villages; the program combines extension services and training with distribution of seeds. Emphasis is placed on growing favorite, local varieties that require minimal water, space, and time (e.g., amaranth, Indian spinach, drumstick, and papaya). After the first nine months of the program, home gardening had increased, with up to half of the start-up gardens showing good yields of DGLV. Some villagers noted that their "home gardens" were actually near their rice fields, where family members work much of the day.

In Madras, carotene-rich foods were largely not available in the market (22). Attempts to increase availability by bio-intensive gardening led to failures because of lack of water and the ravages of domestic animals and poultry. Small-area gardens performed well (e.g., with *Moringa oleifera*, *Sesbania grandiflora*, and *Sauropus androgynus*), but the DGLV were not reaching young children. Observed household and child-feeding practices implied that cereal grains were regarded as "ideal food" and were sufficient for children when dipped into sauces. DGLV were believed to cause malaria in children. The purpose of "Operation CRF" was to increase consumption of trimixes (cereal-pulse-carotene-rich foods) by combatting harmful folk beliefs and demonstrating ways to prepare and serve carotene-rich foods to children (including their removal from the pot before adding spices). Routine feeding of carotene-rich foods to young children increased from 6% of families at the outset to 25% after a first, initial evaluation several months later (22).

A three-year homestead gardening project in Bangladesh served 150 marginal and landless families who were taught to plant and maintain a garden, make compost, and prepare home-grown foods (23). Here a biodynamic approach worked; clearly the design of such projects must be location-specific and culture-specific. Seeds and local extension services were included. Efficient use of land not normally cultivated was a key aim of the project. The percentage of families growing vegetables increased from 55% to 100%, nearly all of whom grew at least six varieties during the year. (None of the families had previously grown this many crops.) Garden-plot sizes increased sixfold, as did consumption by families and children.

The program, which focused on mothers, is now being expanded to 1000 families who will be monitored for changes in food-growing practices, consumption patterns, income gains, and night blindness in children. A monitoring system was found to be essential, but the challenge remains of how to expand this experience to a nationwide program. A discussant later noted that data on the costs of such projects will be crucial for future evaluation of their chances for expansion and sustainability. However, it was also pointed out that initial costs are likely to be much higher than those incurred during expansion of the program as found in Iringa.

Even when proper foods are available and consumed, other factors (e.g., dietary and infectious) may reduce their nutritional effect. A reported study of *Ascaris*-infected

children in Indonesia found that daily intake of modest amounts of carotene-rich foods raised mean serum levels of vitamin A. However, deworming of children and addition of dietary fat (25 g/day as coconut fat) to this regimen further improved the vitamin A status, particularly in those who were more deficient (initial serum vitamin A level,  $< 20 \mu\text{g/dL}$ ) or had a heavier worm burden (24). A paper submitted for this section (but not presented) underscored the ability of carotene-rich foods eaten in normal dietary amounts to improve not only vitamin A status but also hematopoietic indices (i.e., hemoglobin level) (25).

### **Information, Education, and Communication Issues**

This session addressed the question of how to motivate target groups to accept and participate in programs that can control vitamin A deficiency through dietary counselling, gardening, or vitamin A supplementation. A review of 29 communications projects (26) revealed that success, at least in the short term, was more likely when local institutions were strengthened and when informal, participatory nutrition education was given. It was noted that social marketing may or may not utilize these approaches. A communications model was put forth that urges both sets of participants (e.g., educators and the community) to learn from and understand each other (26). Such mutual understanding was found to be essential for a successful program. This pattern contrasts with the classic, unidirectional "source-to-recipient" approach to communication.

#### Nutrition Surveys and Education

Several reports from Asia emphasized the need to understand the community and develop appropriate educational messages in order to improve diet or increase acceptance of vitamin A capsules. A "bottom-up and top-down" communications approach was described for most of these projects; the communities, once sensitized to the nutritional problem(s), participated in the design, conduct and, to a more limited extent, evaluation of programs. Mothers were the primary target audience.

In the Philippines a Department of Health program, assisted by a nongovernmental organization (NGO), sought to reduce xerophthalmia both by supplementation with

large doses of vitamin A and by nutrition education with social marketing (27). Lessons learned included the need for all media (e.g., print, radio, and health-worker advice) to mutually reinforce practical, behavior-oriented messages for child feeding (27). Evaluation of ~ 5000 children and their families found an increased awareness and consumption of DGLV. The same issues emerged in a pilot program in Bangladesh, where multimedia messages were coordinated in content and timing. There were 75-85% increases in the apparent frequency of DGLV consumption by children and mothers (28).

A comprehensive project in northeast Thailand (29) undertook a formative evaluation of primary caretakers of children, potential motivators (e.g., teachers and health workers), influential persons, and local institutions in the district to identify one key, common, nutritious vegetable (i.e., the ivy gourd) and to develop a social-marketing strategy to promote its consumption. An extensive campaign was launched to introduce the ivy gourd into home and community gardens, to develop and distribute local recipes for the ivy gourd, and to reinforce the use of the vegetable in diets for families and children. Investigators observed that mothers were not convinced of the need to prepare and consume more vitamin A-rich foods to prevent (rarely seen) blindness in children; however, they were more willing to change dietary practices when they were informed that the change could help their children to combat diarrhea or respiratory infections. [A similar observation was made with reference to vitamin A capsule receipt in Guatemala (15)]. Investigators also observed that the intended behavioral change could not be excessive, or the project would fail. After three years investigators noted that gardens with ivy gourds blanketed the district (29).

A second Thai project for communicating information on vitamin A in the northeast part of the country sought to control vitamin A deficiency by targeting primary schoolchildren and their families (30) and thereby also improving the nutritional quality of the local school-lunch program. Activities focused on gardening, motivation, school lunches, and selected health activities. Nineteen schools participated, including one control. Cohorts of children were followed for two years. The proportion of participating children able to identify food sources of vitamin A and to state the health benefits of increased vitamin A intake rose dramatically over that

of control children. The prevalence of vitamin A deficiency declined in participants, as reflected by impression cytology, serum retinol levels, and dark-adaptation time.

### Social Marketing

The aim of a multimedia, social marketing project promoting use of vitamin A capsules in Central Java, Indonesia, was to increase the numbers of mothers and children attending monthly health post sessions, thereby increasing the proportion of children taking capsules during special campaigns (31). The "target audience" for behavioral change was mothers. The "target beneficiaries" were their one- to four-year-old children. A one-year evaluation showed that while mothers' knowledge about capsules did not change, coverage rates of children increased from 24% to 40%. The rate was unchanged in control areas. Coverage was directly linked to the frequency of attendance at the monthly health post.

Central to educating the public and ourselves is the need to communicate with illiterate populations. Three papers in this meeting (at different sessions) presented pictorial questionnaires and checklists for assessing dietary intake (32,50) and morbidity (19). A pictorial questionnaire for schoolchildren is being tested among the Tarahumara Indians in rural Mexico (32); its purpose is to increase children's awareness of the need for and contents of a nutritious diet, and to encourage child-to-child and child-to-family teaching. Picture messages were also reproduced as posters. In Guatemala a pictorial flip-board and game-board are being developed to estimate seven-day intakes of vitamin A-rich foods by preschool children (50). Sixty-eight pictures were chosen from 550 photographs of prepared local foods. In taking pictures of food for such an instrument, one should present the most familiar form and mode of preparation of a food. Also, the actual shape, color, and quality of the vegetable or fruit affect their recognition, as does the background color, texture, and type of plate and utensils in the picture.

A four-year family health and econo-demographic study in southwestern Kenya drew attention to the complex influences on dietary vitamin A intake and its effect on illness in children (33). For example, household consumption of vitamin A was only weakly predictive of children's intake levels. With increased household income the caloric intake of children was higher, but vitamin A intake was lower, apparently because of

substitution of vegetables with more "prestigious" foods of high-caloric but low-nutrient (i.e., vitamin A) density. These findings reinforce the need to tailor nutrition education for targeted groups and to recognize the distinctions between household and child-feeding patterns. As dietary intake of vitamin A increased among children, the incidence and prevalence of total illness and lower respiratory infections and the incidence of diarrhea declined. There was an association between the prevalence of lower respiratory infections and mortality.

Dean Alfred Sommer summarized this two-day mini-symposium on community-based interventions (34). He noted the "common denominator" for all successful community-based interventions: community ownership and involvement that, in turn, encourage support and participation. These elements are critical for compliance and sustainability of any type of program, whether it be vitamin A supplementation, gardening, dietary modification efforts, or sanitation and hygiene improvements. Short-, medium-, and long-term plans are best developed by the community and implemented according to local priorities and skills. These various approaches are not exclusive but complementary; each combination is tailored to the unique attributes of the community. The diversity of approaches presented at this meeting was an indication that "we have only begun to scratch the surface, but that a scratch has been made" in defining and delivering interventions to prevent vitamin A deficiency that are developed, understood, carried out, and sustained by the community.

## **SPECIAL SESSION ON COMMUNITY-BASED INTERVENTIONS**

An informal Thursday evening session reaffirmed the importance of community empowerment and participation in planning, implementing, monitoring, and evaluating local interventions (35). It was agreed that communities are heterogeneous. Goals of individuals may not coincide with those of the community; thus, the importance of the people's (especially women's) support and participation in a program was stressed. Participants emphasized the need for NGOs to pay special attention to factors that can elevate a small project into a far-reaching movement that could stimulate large-scale, positive change. Such a movement is more likely when NGOs work in earnest partnership with their host government, and when governments give active recognition to NGO efforts.

## **PERSPECTIVES ON VITAMIN A FORTIFICATION**

Although fortification is often not viewed as a community intervention, the process cannot occur--and the nutritional effect cannot be achieved--without support from national and regional government leaders, the local food industry, professional institutions, and consumer advocacy groups. In his opening remarks Dr. Michael Latham suggested that fortification be considered along with vitamin A supplementation and other measures to improve diet, whenever practical, appropriate, and affordable (36). Vitamin A fortification is a viable option where local dietary efforts prove difficult but where centrally processed, technically fortifiable, and widely consumed foods exist. More than a decade ago fortification of monosodium glutamate (MSG) with vitamin A was shown to be effective in controlling vitamin A deficiency in the Philippines. This early success led Indonesia to consider and test fortified MSG as a practical way to prevent vitamin A deficiency.

### **Vitamin A-Fortified Monosodium Glutamate**

Mr. Steve Wilbur reviewed the MSG-vitamin A (MSG-A) fortification process in Indonesia which has served as an important model for showing (1) how food carriers are identified and evaluated, (2) how a national fortification policy may be promoted within the health, industrial/commercial, and private sectors, and (3) how such an effort might be financed for sustainability (37). Exploratory studies identified MSG as an inexpensive, centrally produced, fortifiable product routinely consumed by >95% of the population. Technical problems in fortifying white MSG with yellow vitamin A were resolved over a seven- to ten-year period. The beadlets of vitamin A had to be coated white, and they had to be moisture-resistant, nonseparable from the MSG, dispersable in food, biologically available, inexpensive, and religiously acceptable.

A controlled field trial found that serum levels of retinol and hemoglobin rose, xerophthalmia rates decreased, linear growth improved, and mortality decreased among preschool children living in villages receiving vitamin A-fortified MSG as compared with controls. Levels of vitamin A in maternal breastmilk also rose. Commercial distribution of MSG fortified with vitamin A began in three provinces in June 1989, as a first step toward national distribution. However, the product began to discolor after about three months under local storage conditions, and the program

was temporarily halted in December 1989. Two new prototype products are being field-tested while a cost recovery system is being developed. There is no substitution for perseverance.

Vitamin A-fortified MSG has potential application throughout much of Asia: Vietnam has already approved its use.

### **Vitamin A-Fortified Sugar**

The major success achieved with a national program of fortification of sugar with vitamin A in Guatemala more than a decade ago was reviewed by Dr. Omar Dary. National random surveys over time showed that the prevalence of low levels of vitamin A in serum ( $< 20 \mu\text{g/dL}$ ) decreased from 22% at baseline to 9% two years later. Pilot projects in Costa Rica and Honduras found similar changes compared to 1966 levels. In all countries the program stopped a few years later due to financial difficulties and lack of enforcement measures. A Guatemalan survey in 1988 found a prevalence of low serum levels of vitamin A in preschoolers to be again 22%; this finding was further evidence that fortification had effectively controlled vitamin A deficiency (38). The program has now restarted in Guatemala at a fortification level of  $\sim 50$  IU of vitamin A/g of sugar. Children consuming  $\sim 20$  g of sugar/day receive  $\sim 1000$  IU of vitamin A/day. The current cost of fortifying  $\sim 9$  million quintals/year is US \$0.26/person, currently paid by the Association of Sugar Producers of Guatemala. The government provides tax exemption for importation of materials. INCAP monitors the premix, while the government monitors the level of vitamin A in marketed sugar.

Honduras, despite legislation, currently fortifies only about half of its domestically consumed sugar with vitamin A. Costa Rica briefly resumed but is not currently fortifying sugar. Panama is planning to start its fortification scheme. Nicaragua has no plans for vitamin A fortification of sugar. Despite the previous successes and the resurgence of sugar fortification, Dr. Omar Dary emphasized that (1) long-term financing solutions (involving foreign exchange) and legal enforcement will be required for sustainability and (2) sugar fortification is seen as an adjunct to continuing work to improve dietary quality of high-risk groups in Central American countries.

## **VITAMIN A AND CHILDHOOD MORBIDITY AND MORTALITY: REPORTS FROM CLINICAL TRIALS**

The impact of improved vitamin A nutrition on child health and survival was the major theme of the XIII IVACG Meeting in Kathmandu, Nepal, in 1989. At that time three major clinical trials were completed, one in Indonesia and two in India, and results of the India studies were reported at the Nepal IVACG meeting. However, several vitamin A supplementation field trials described at the Nepal meeting were still underway at that time in Nepal, Sudan, and Ghana. Results of those studies that have been completed to date (two in Nepal, one in Sudan), baseline findings from the Ghana trial, and several related studies on vitamin A and morbidity were reported and discussed in Ecuador. [Evidence of association between dietary adequacy and morbidity and mortality in Kenya was presented earlier (33).]

### **Community and Clinical Trials in Africa**

The first of two community trials to evaluate the impact of semiannual vitamin A supplementation on child mortality in Africa has been completed in northern Sudan (39). Children aged six to 71 months were randomized at the household level to receive vitamin A (200,000 IU) or placebo every six months for 18 months. A total of 29,615 children were enrolled, 84% of whom were followed for the entire period. Treatment groups were reported to be comparable at baseline: the baseline prevalence of xerophthalmia was ~3.0%; mean height for age was -1.9 Z-scores, and weight for height was -1.0 Z-scores in both treatment groups. There were 112 and 120 deaths reported in the control and vitamin A-treated groups, respectively. There was no apparent reduction in mortality due to vitamin A supplementation. The estimated relative risk for vitamin A recipients in relation to the placebo group was 1.06 (95% CI = 0.82-1.37).

The second double-masked, controlled trial in Africa is still underway in Ghana (40). Approximately 14,500 children six to 71 months were enrolled at baseline and randomized at the field-worker level to receive 200,000 IU vitamin A or a placebo capsule every six months for two years. Baseline data for the combined treatment groups were presented at the meeting. The prevalence of active xerophthalmia was low, but corneal scarring rates (XS) were high: night blindness (XN) = 1.1%, Bitot's

spots (X1B) = 0.012%, corneal xerosis and keratomalacia (X2/X3) = 0.014%, and XS = 0.09%. In a subsample of children (n=608) the prevalence of low levels of retinol in serum (<0.35  $\mu\text{mol/L}$  or 20  $\mu\text{g/dL}$ ) was 14.0%. Abnormal impression cytology was diagnosed in 141 of 471 subsampled children (29.9%). Mortality impact data are expected from the Ghana trial by mid-1992.

While findings from Ghana are awaited to clarify the effect of vitamin A on child mortality in Africa, further evidence was presented for the value of vitamin A in the treatment of severe measles in Africa. A randomized, double-blinded, hospital-based clinical trial was carried out in Durban, South Africa, to evaluate the efficacy of vitamin A in reducing morbidity among 60 children four to 24 months of age who were hospitalized with severe measles (41). Treatment groups were comparable in socioeconomic, nutritional, and immunologic status. Ninety percent of the children had baseline serum retinol levels of <20  $\mu\text{g/dL}$  (mean  $\cong 12.0 \pm 1.1$  for both groups). An "integrated morbidity score" (IMS) was developed and was based on clinical evidence of diarrhea, pneumonia (radiographically confirmed), and herpes infection. Ninety-six percent of vitamin A-treated children had fully recovered clinically within eight days as compared with 65% of the placebo-treated children. IMSs were reduced by 82%, 61%, and 85% in the vitamin A treatment group at six days, six weeks (80% follow-up), and six months (60% follow-up) after treatment, respectively.

### **Community and Clinical Trials in Asia**

Two field trials of large-dose vitamin A supplementation have been completed in Nepal, one in the low-lying, Gangetic floodplain basin (42) and a second in the hilly region of the country (43). The "NNIPS" study randomized, in a double-masked fashion, 261 communities for their children six to 71 months of age (n=28,610) to receive 200,000 IU or 1000 IU (control) of vitamin A as a capsule every four months for a year (42). At baseline treatment groups were nearly identical in socioeconomic, health, and anthropometric status as well as in prior infant mortality (82/1000 live births) and mortality among one- to four-year-old children (13 and 12/1000 children in vitamin A and control groups, respectively). The prevalence of xerophthalmia in subsamples of each treatment group was  $\sim 3.0\%$ . The proportion of children in both treatment groups receiving capsules was estimated at  $>90\%$ , and vital status

reporting for both groups was >98% at each round. Mortality rates after 12 months were 11.5 and 16.4 per 1000 child-years in the vitamin A and control groups, respectively, yielding a 30% reduction in mortality (i.e., relative risk = 0.70; 95% CI=0.56-0.88). The impact was consistent for all ages, both genders, across the observed range of anthropometric status, and in all seasons of the year. The trial was discontinued in accordance with the recommendation of a data safety and monitoring committee due to the size and significance of the impact. All participant children in this age group are now receiving routine vitamin A prophylaxis every four to six months. A first report from this trial was published in July 1991.

The second, controlled field trial in Nepal evaluated the impact of a single dose containing 200,000 IU of vitamin A supplement (100,000 IU for infants) in reducing mortality among children one to 59 months of age in Jumla located in the western hills of Nepal where xerophthalmia rates and infant and child mortality are extremely high (43). Although not a randomized or double-masked trial, the study evaluated the first round of capsule distribution of a program in an area with a well-developed, vital surveillance system. Approximately 7200 children were enrolled, dosed, and followed for five months after dosing. Areas where children were given supplements and control areas were comparable in regard to factors measured at baseline. Mortality rates in supplemented and control villages were 93.2 and 126.2/1000 child-years, respectively; the protective relative risk was 0.74 (95% CI=0.55-0.99), or a 26% reduction in mortality.

To place these results in perspective, it may be noted that the reduction in mortality of ~30% observed in these field trials in Nepal are consistent with reductions found in Indonesia. One trial using a frequent low dose in south India noted ~50% reduction in mortality. Another trial, in central India, has not found a significant reduction in child mortality with vitamin A supplementation every six months. Although the figure was debated, it was suggested that several hundred thousand to 1 million child deaths in south Asia may be preventable each year by insuring adequate vitamin A nutriture.

## **VITAMIN A AND CHILDHOOD MORBIDITY AND MORTALITY: RELATED REPORTS**

Three papers dealt with the complex pathophysiologic and nutritional dimensions of vitamin A deficiency that may underlie, in part, its role(s) in child health and survival. Continued analyses from a randomized, double-masked trial of 236 mildly xerophthalmic and clinically normal preschool children in Indonesia showed that primary and secondary IgG responses against tetanus (used as a sentinel immunogen) were more than twofold higher than those of placebo-controls three weeks after receiving a 200,000-IU dose of vitamin A (44). In-vitro T-cell responses to tetanus did not differ between the two groups. IgG responses to influenza vaccine were higher in the vitamin A-supplemented group than in the placebo group, but no differences were observed in response to oral polio vaccine. Thus, vitamin A appears to affect elements of the immune response, although the mechanisms remain unclear.

The "barrier function" of mucous-secreting epithelial tissue may also be affected during vitamin A deficiency. Findings from postmortem examinations of 71 malnourished children who died of pneumonia were reported from the Philippines (45). Extensive squamous metaplasia of the trachea and bronchi, consistent with that seen in experimental vitamin A deficiency and in disease states that may predispose children to vitamin A deficiency (e.g., cystic fibrosis), was found in 62 patients (87%). Vitamin A status was not directly assessed in the study. Although the literature on animal studies clearly demonstrates squamous metaplasia of respiratory epithelium with vitamin A depletion, similar evidence in children is sparse; it is limited to a few very early autopsy studies.

One study of a vitamin A-nutrient interaction was reported from Thailand. A double-masked clinical trial of 140 schoolchildren, who were shown biochemically to be deficient in vitamin A and zinc, found that daily supplementation with both vitamin A and zinc had a greater effect than vitamin A alone on conjunctival goblet and epithelial cell recovery, as measured by impression cytology (46). Supplementation with both vitamin A and zinc improved dark adaptation (reflected by vision restoration time, see below) over baseline. These findings should alert us to potential multi-micronutrient deficiencies where deficiency of any one exists.

## **SPECIAL SESSION ON VITAMIN A STATUS AND CHILDHOOD MORBIDITY AND MORTALITY**

This Thursday evening session provided further opportunity for questions and discussion on mortality studies that were presented as well as on others that were not presented (but whose investigators were on hand) (47). A candid debate ensued about characteristics of the studied populations, their ecologies, health services, and the design and conduct of the trials that could have explained differences in observed impact on mortality. It became apparent that factors to explain fully the differences in outcome were not likely to be found. One message was implicitly clear: large, community-based trials such as those carried out to evaluate the impact of vitamin A on mortality require proper design, detailed planning, thorough execution, close monitoring, and strictly managed supervision. Nevertheless, real differences will remain. Factors thought to influence outcome were identified at an earlier meeting of principal investigators in Geneva (see page 33).

## **UPDATE ON ASSESSMENT TECHNIQUES**

This session addressed issues ranging from measurement of vitamin A status, dietary intake, and basic survey techniques to reports of a survey and a study of maternal vitamin A supplementation. Prof. James Olson succinctly reviewed the principles, strengths, and limitations of current methods to assess vitamin A status and dietary intake (48). He suggested that vitamin A status be understood in terms of total body stores, since essentially all stores of vitamin A are bioavailable and therefore can be utilized. A five-stage classification system may be preferable to current definitions of status; the five stages proposed were deficient, marginal (includes mild and subclinical vitamin A deficiency), satisfactory, excessive, and toxic vitamin A status.

Assessment methods may be broadly assigned to six categories. (1) Night blindness-related: assessed by interview, vision restoration time, rapid and full dark-adaptation times; (2) clinically related: assessed by clinical eye signs, impression cytology by disk application, impression cytology with transfer; (3) serum vitamin A-related: assessed by frequency distribution curves, relative dose response (RDR), modified relative dose response (MRDR), and the retinol-binding protein response;

(4) total body reserves-related: assessed by liver biopsy and isotope dilution; (5) diet-related (for assessing vitamin A or carotenoid intake): assessed by food-frequency questionnaire, simplified food-frequency questionnaire, food diary, etc., with or without the use of food composition tables. Indicators that may be considered to reflect vitamin A status in the future include immune response and tear-based assays. The choice of an indicator depends on its purpose, appropriateness, feasibility, cost, and other factors. Although there is some correlation among indicators, a direct 1:1 correspondence should not be expected because many are based on different biological principles (48).

### **Vitamin A Status and Intake of Individuals**

Of the techniques listed above, the MRDR has been introduced in recent years as an indicator of hepatic vitamin A stores. A dose of 2,4-dihydroretinyl acetate is given (100  $\mu$ g/kg of body weight), and blood is drawn 5 hours later. No baseline blood specimen is required. The MRDR value equals the molar ratio of 2,4-dihydroretinyl acetate to retinol in serum at 5 hours. A ratio of  $>0.03$  is considered to represent a marginal or deficient state. Intra-individual variability over several months appears to be very low. Abnormal values return to  $<0.03$  with vitamin A supplementation. Separate studies showed that one (4%) of 24 American children had high (i.e., marginal or deficient) values as compared with 33 (62%) of 53 Indonesian preschool children (49).

Two papers addressed different issues related to dietary assessment. One (discussed in the session on community-based intervention issues) described a technique to elicit seven-day recall of intake of vitamin A and carotene-rich foods by use of a pictorial checklist (50). A second report from Haiti evaluated the IVACG simplified dietary assessment (51). Preliminary focus group sessions, 24-hour recalls, and observational methods were used to describe local foods, their patterns of consumption, and typical portions fed to children. Vitamin A content was derived from several published food composition tables and other sources. Intakes of 177 randomly sampled children in 30 village clusters were formally assessed by food frequency and 24-hour recall, as suggested by the IVACG simplified dietary assessment, over a nine-week period.

Difficulties were found in translating the guidelines into simple methods that could be followed by field workers, in linking local foods to vitamin A values published in different and varied sources, in computing summary measures from a large amount of data without a computer, and in interpreting and acting on these measures in terms of dietary counselling to families. The outcome measures, the Consumption Index (CI) and the Usual Pattern of Food Consumption (UPF) score, did not agree in categorizing children at risk (rates of 10% and 37%, respectively); thus questions were raised about the accuracy of these guidelines for risk assessment. These criticisms were discussed in light of how the IVACG simplified dietary assessment may be improved and who should be the intended end-user of the instrument and results.

### **Vitamin A Status of Populations**

Several agencies have used a low-cost, rapid approach to assessing risk of vitamin A deficiency in a country (52). When the presence and extent of the problem are not known, this seven-step process can provide useful information for program planning. (1) Check whether the country is listed by WHO as likely to have a vitamin A deficiency problem. (2) Search national policy statements for evidence of plans to control xerophthalmia. (3) Consult with local clinicians and agencies about the existence of xerophthalmia in their areas. (4) Collect and review published and, more importantly, unpublished reports that may be in government and NGO files. (5) Ascertain local knowledge and descriptive terms about night blindness. (6) Examine high-risk groups (e.g., nutrition rehabilitation centers and pediatric and measles wards of hospitals) for evidence of xerophthalmia. (7) If a public health problem is likely, collect data on availability, market patterns, gardening, and dietary practices relevant to vitamin A- and carotene-rich foods that may offer clues for local resolution of the problem.

Information from the above approach may suggest the need for an epidemiologic survey in one or more regions to quantify the extent, severity, and risk factors of vitamin A deficiency. Such a population-based approach was carried out in north and northeast Thailand, where a random sample of nearly 1000 children aged two to six years in five high-risk districts were examined in two different seasons for eye signs, serum biochemistry including the RDR (in a 20% subsample of children),

conjunctival impression cytology (in a 20% subsample of children), and anthropometry (53). No xerophthalmia was observed, although 14% and 7% of children had serum retinol levels of  $<20 \mu\text{g/dL}$  in the dry and rainy seasons, respectively. The RDR and impression cytology methods gave similar prevalences of deficiency: 20% and 18%, respectively.

The purpose of the investigation will guide the choice of assessment methods and indicators. In India, retinol levels in maternal and cord plasma were employed to evaluate the adequacy of dosage and duration of vitamin A supplementation during pregnancy (54). A supplement of  $1800 \mu\text{g}$  of vitamin A per day for  $\geq 12$  weeks of pregnancy was found to be necessary to maintain normal vitamin A status of mothers; this level of supplementation represents a need for  $\sim 780 \mu\text{g}$  of retinol equivalents per day. Low-level vitamin A supplementation during pregnancy also appeared to increase maternal hemoglobin and progesterone levels as compared with controls. However, no effect was observed on birthweight of the infants.

The session on assessment ended with a briefing by Prof. Olson on the status of a report being prepared by the IVACG Assessment Methodology Task Force (55). This report is being prepared by a group of several authors experienced in one or more of the vitamin A assessment methods: histological (conjunctival impression cytology and impression cytology with transfer), physiological (visual restoration time and history of night blindness), rapid dietary assessment, and biochemical (serum retinol distribution, 30-day serum vitamin A response, and 30-day RDR). The report will briefly describe the methods as they relate to vitamin A status, provide general reference points, address advantages and constraints to their use, and provide guidelines for their interpretation and application. Pertinent references will also be cited.

## **SPECIAL SESSION ON ASSESSMENT TECHNIQUES**

Participants in this session, held on Thursday evening, discussed the vitamin A status classification scheme outlined by Prof. Olson earlier, noting the usefulness of viewing status as a continuum from deficient through toxic, while recognizing the importance of cut-offs for each indicator (56). Total vitamin A stores in the body are reflected by vitamin A content of the liver. New biochemical methods are increasingly

available to assess liver storage (e.g., RDR and MRDR); these methods may have potential for use in the field. However, the risk (in relation to human immunodeficiency and hepatitis B viruses) of drawing and analyzing blood products was noted. In terms of dietary assessment, the group encouraged FAO to continue updating its food composition tables for use in developing countries. Dietary assessment of vitamin A intake requires further research on reliability and validity of available measures; it must be realized that measurement of dietary intake does not equal measurement of nutrient status. IVACG was encouraged to maintain its leadership role in developing and testing assessment methods.

## **NONGOVERNMENTAL ORGANIZATION PRESENTATIONS**

Different roles and a variety of program achievements were presented by representatives from several leading NGOs. These presentations are summarized below.

### **Helen Keller International**

Now with ~ 20 years of experience in prevention of vitamin A deficiency, Helen Keller International (HKI) analyzed its role as a catalyst, advisor, and teacher to governments and other private agencies working in health care delivery (57). HKI employs a programming model that involves collaborative assessment and planning of an intervention (e.g., capsule distribution, nutrition education, social marketing, home gardening, and fortification), monitoring activities, evaluating impact, and readjustment based on findings.

### **Vitamin A Technical Assistance Program**

The Vitamin A Technical Assistance Program (VITAP) began in 1988 and presently serves 22 countries. VITAP assists in developing national prevention strategies, provides consultants, and serves as a repository for over 700 reports, publications, and videos dealing with vitamin A deficiency and its prevention.

## **World Vision**

World Vision offers a wide range of child health, agricultural, and community development services in 96 countries around the world (58). Prevention of vitamin A deficiency was formally added to its child-survival activities in 1986; major vitamin A projects serving nearly 70,000 children are ongoing in Bangladesh, Mauritania, and Haiti. Because of its emphasis on delivery of services, World Vision relies on existing data (e.g., WHO, USAID, and local government reports) to decide on vitamin A programming for a country. The type of intervention reflects community priorities and decisions as well as availability of resources. This basic approach has had success in increasing gardening, consumption of vitamin A-rich foods, and the proportion of the target population receiving vitamin A capsules in project countries.

## **Sight Savers**

Previously the Royal Commonwealth Society for the Blind, Sight Savers has long served the cause of prevention of blindness and development of infrastructure (59). In India nearly all of this organization's earlier centers to prevent xerophthalmia have evolved into child development centers offering wider ranges of health care services; and in 1991 its three millionth cataract operation was performed in Pakistan. Since 1990 Sight Savers has been serving non-Commonwealth countries as well. Programs emphasize in-country professional training, advanced training in the United Kingdom, and integrated education for the blind, including a new focus on "early learning" (i.e., preschool) for blind children.

## **International Eye Foundation**

The International Eye Foundation (IEF) now has vitamin A programs in three countries: Malawi, Guatemala, and Honduras (60). In Malawi a large USAID-funded survey of blindness carried out by IEF in 1983 under the auspices of the Ministry of Health in collaboration with the Dana Center for Preventive Ophthalmology, Sight Savers, WHO, and HKI, stimulated development of a child survival project with vitamin A, immunization, oral rehydration therapy, and routine eye screening components. This was an example of how a population-based survey led to preventive community-based action. In Guatemala, IEF is presently carrying out

surveys of vitamin A-rich foods and household food consumption patterns, promoting school and household gardening programs, and working with the Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM) to analyze local foods for vitamin A activity. In 25 peri-urban communities in Honduras, IEF promotes vitamin A supplementation, urban gardening, and nutrition education. In these communities, IEF additionally supports Ministry of Health child survival initiatives in oral rehydration therapy and immunization. In collaboration with USAID and the PVO Child Survival Support Program of The Johns Hopkins University, IEF hosted the 1991 Child Survival Workshop for private voluntary organizations working in Latin America and the Caribbean. The workshop was held in Honduras.

### **Christoffel Blindenmission**

In partnership with national and private organizations Christoffel Blindenmission (CBM) carries out blindness-prevention activities in over 100 countries (61). Prevention of vitamin A deficiency is an integral part of its eye-care services, which include training of eye-care specialists in the diagnosis and treatment of xerophthalmia, nutrition education, and vitamin A supplementation, depending on local circumstances. In 1990 Christoffel Blindenmission and Sight Savers jointly sponsored a WHO meeting on childhood blindness in London; at this meeting it was reported that xerophthalmia is the leading cause of childhood blindness in Africa and Asia. A report of this meeting will be available shortly.

During the discussion a lively debate ensued about several issues related to the critical roles of NGOs in the development process: (1) the success of the community participatory process in NGO-operated community-based interventions; (2) the sustainability of NGO programs; and (3) the indications that emerge from NGO vitamin A programs that would predict national potential. Many NGO programs are guided by the "Triple T" injunction: take Time, build Trust, do Trial.

## **AGENCY PRESENTATIONS**

### **Pan American Health Organization**

A steady decline in the socioeconomic conditions in the region of the Americas appears to underlie, in part, cutbacks in public health programs (62). One consequence is an apparent decline in the nutritional health of the population (62). For example, clinical and biochemical vitamin A deficiency is increasing, with apparent declines in vitamin A intake in high-risk groups in many countries (e.g., Ecuador, Guatemala, and Belize).

In response to this trend, PAHO is promoting a five-point initiative to (1) increase coverage and strengthen the capacity of its health and nutritional surveillance systems; (2) develop policy and multisectoral plans with governments and local agencies; (3) promote the development of a stronger nutritional component within the primary health care system; (4) give special attention to micronutrient deficiencies; and (5) actively promote the development of human resources.

Efforts to control vitamin A deficiency are forecast to continue through 1999, with the aim of eliminating vitamin A deficiency as a public health problem in the region by the year 2000. A reformulated plan is expected by 1992. It will probably include research and technical assistance to reassess the extent and severity of deficiency; identify priority areas for vitamin A supplementation and assess its impact; promote and monitor efforts to fortify sugar with vitamin A; promote increased knowledge, production, and consumption of vitamin A- and carotene-rich foods within the region; and promote the development of local weaning foods.

### **Food and Agriculture Organization of the United Nations**

The United Nations' 10-year program to control nutritional blindness and eliminate vitamin A deficiency as a public health problem by the year 2000 requires a coordinated multiagency approach (63). FAO has the mandate to assist governments with the long-term solution: increase the production, adequacy, and consumption of vitamin A- and carotene-rich foods. This approach recognizes that increased availability is not enough; a positive change in dietary behavior leading to

improved vitamin A nutriture is essential. Nutrition education via face-to-face counselling, video/television, and radio is needed to reinforce desirable dietary habits once they are identified. Nutrition education through mass communication is a priority component in the FAO Vitamin A Programme.

As an example, the FAO Technical Cooperative Programme will support a two-year initiative on nutrition education through mass media in five sub-Saharan countries of Africa to assist the respective governments and collaborate with UNICEF, Helen Keller International, and the Academy for Educational Development. During the two-year project period regional training courses will be held, a regional coordination network will be established, and national multimedia programmes focused on topics that could be expected to lead to increased availability and consumption of vitamin A-rich food will be supported.

### **U.S. Agency for International Development**

The USAID Office of Nutrition has a longstanding commitment and record in promoting and supporting programs to control vitamin A deficiency around the world (64). Host country governments are considered active counterparts in all of the Office of Nutrition, Bureau for Science and Technology (S&T/N) or simply the Office of Nutrition's efforts to prevent vitamin A deficiency. Office of Nutrition-supported activities can be categorized as research, technical assistance and training, and collection and dissemination of information.

The Office supports and manages an active, applied research program directed toward understanding and quantifying the relationship between vitamin A deficiency and child morbidity and mortality, developing and testing practical assessment techniques, and evaluating the sustainability of vitamin A deficiency control programs. Recent research projects include the large, community-based, vitamin A intervention trials reported at this meeting from Nepal (42) and Sudan (39). The Office of Nutrition also supported the original vitamin A intervention trial to reduce mortality in Aceh Study in Indonesia. Ongoing field studies include evaluation of the impact of vitamin A supplementation on early infant mortality in Nepal and evaluations of the tolerance for vitamin A of young infants in Nepal and Indonesia. At times the Office of Nutrition supports research workshops to share and exchange

information among researchers such as that which occurred in Geneva in May 1991 (see consensus statement, page 33).

The Office carries out much of its technical assistance through the VITAL project and the Dana Center for Preventive Ophthalmology at Johns Hopkins University (Baltimore, MD). Recent VITAL activities have included developing a management information system in Malawi, gardening and nutrition education projects in Niger, vitamin A surveys in the South Pacific and Bolivia, assisting the Integrated Child Development Services Scheme in India, and efforts to develop and promote solar drying and other indigenous food preservation methods in Haiti and Senegal. Technical assistance from the Dana Center focuses on aiding governments and agencies to conduct surveys and public health research on vitamin A deficiency and its control.

Information collection and dissemination is carried out under a cooperative agreement with The Nutrition Foundation, Inc., to support IVACG and its activities (e.g., meetings and task forces). Examples of publications include the VITAL newsletter, IVACG publications, Vitamin A Facts, and scientific articles from sponsored research.

The Office of Nutrition is committed to controlling vitamin A deficiency as a public health problem by the year 2000. However, vitamin A deficiency must be seen within the broader context of multiple micronutrient deficiencies that afflict the poor. The Office is addressing some of these broader nutritional problems by supporting the Famine Early Warning System in sub-Saharan Africa, nutrition education efforts through the Academy for Educational Development, and the Women, Infant, and Child Project.

### **WHO Expanded Programme on Immunization**

There is no single solution for controlling vitamin A deficiency (65). The mix of interventions may vary by country according to need, existing programs onto which interventions can be added, and available resources. However, every possible option must be sought if the goal of controlling vitamin A deficiency by the year 2000 is to be realized. WHO is evaluating the possibility of linking vitamin A

supplementation to the Expanded Programme for Immunization (EPI) in response to a 1986 Global Advisory Group recommendation to combine micronutrient supplementation with vaccination where such combination is justified and feasible.

The EPI offers enormous potential for expanding one type of intervention: large-dose vitamin A prophylaxis. Currently, EPI has contact with >500 million infants and mothers each year. It is estimated that in many countries vaccine coverage through the existing primary health care system is ~80% in the first year of life. Although vitamin A distributed through the EPI can reach only infants and women of childbearing age (by design), this coverage is excellent compared to most vertical vitamin A distribution programs, and evidence for the benefits of vitamin A supplementation very early in life is increasing. It is projected that the incremental cost of supplementation would be ~US \$0.50-0.75 per contact per year. The cost of a vertical program for distribution of vitamin A would be five to 10 times more expensive.

Current global recommendations are to provide a high dose of vitamin A to infants after six months of age, perhaps with measles vaccine, and to mothers within four weeks of delivery. WHO recognized that joining delivery of vitamin A with the EPI represents only a partial and temporary solution to the problem, and one that does not address dietary determinants. However, concomitant administration of an immunization and vitamin A during infancy may have a substantial impact on reducing deficiency and its health consequences at modest cost in the foreseeable future by use of delivery systems already in place.

### **WHO Southeast Asia Nutrition Research-cum-Action Network**

The newly established Southeast Asia Research-cum-Action Network involves 11 countries in the Southeast Asia Region (Bangladesh, Bhutan, India, Indonesia, Maldives, Mongolia, Myanmar, Nepal, Democratic Peoples Republic of Korea, Sri Lanka, and Thailand), each with a national "focal point" to be responsible for nutrition-action programs in an operational or advisory role (66). There are four "core" nutrition research centers: the Institute of Nutrition at Mahidol University in Thailand (present secretariat); the National Institute of Nutrition in Hyderabad, India; the Nutrition Research and Development Center in Bogor, Indonesia; and the

Maharaja Sayajirao (MS) University in Baroda, India. These centers will be jointly responsible for strengthening nutrition research, information exchange, and action programs in member countries. The aim of the network is to advance nutrition research on important regional problems and to advise governments of member countries.

Three modes of operation have been identified: (1) research-cum-action projects (i.e., research that can lead to action); (2) information exchange (newsletter and scientist exchanges); and (3) training of researchers, nutrition programmers, and community program managers to conduct appropriate research and evaluation. Five research priorities were agreed upon last year. Primary responsibilities were distributed among the four core centers. These responsibilities included (1) developing multimix weaning foods, (2) identifying and advancing the availability and consumption of vitamin A- and carotene-rich foods, (3) pursuing opportunities for double-fortification of salt with iron and iodine, (4) evaluating and improving compliance of pregnant women taking iron supplements to reduce anemia during pregnancy, and (5) developing a replicable nutrition surveillance system.

## **UNICEF**

The World Summit for Children held in New York in September 1990 was a unique demonstration of commitment (67). It adopted the World Declaration on the Survival, Protection, and Development of Children as well as a Plan of Action, now signed by over 100 heads of state or government. One of the Plan's goals for the decade is the "virtual elimination of vitamin A deficiency and its consequences, including blindness," a goal previously adopted by the governing bodies of WHO and UNICEF. The Plan of Action urges all governments to prepare national programs to implement the commitments of the Summit and urges international development agencies of all kinds to collaborate and contribute to the achievement of the goals. The Secretary-General of the U.N. has obtained assurances from the heads of U.N. agencies to this effect. As a follow-up, an international policy conference on overcoming micronutrient malnutrition, "Ending Hidden Hunger," will be held in Montreal in October 1991. Co-sponsors with WHO and UNICEF are FAO, United Nations Development Programme, the World Bank, the Canadian International Development Agency, and USAID. Participants from some 50 countries will discuss how to

accelerate progress towards attaining the Summit's goals related to iodine, iron, and vitamin A.

The long-term sustainable approach to meeting the vitamin A goal must be through dietary diversification, in the context of overall improvement in nutrition status. Often this type of dietary alteration will involve behavior change. The fact that such change may take a long time makes it all the more imperative to start soon. However, because the Summit's goal has a time frame, in many countries this approach must be combined with other measures in order to achieve a more rapid impact. Such measures include fortification and supplementation through many channels, including EPI. Attention should be given to addressing micronutrient deficiencies in a coordinated way, in terms of both intervention and monitoring and surveillance. Much misinformation, prejudice, and discrimination must be overcome if we are to achieve our nutrition goals.

#### **Report on a Joint Consultation on Intervention Trials: Consensus Statement**

Dr. Frances Davidson summarized a joint USAID/WHO/NEI Consultation of Principal Investigators of Vitamin A Trials, Geneva, 28-29 May 1991. Arising from that meeting was the following consensus statement that expands upon the previously disseminated statement of the IVACG Steering Committee.

*Vitamin A is an essential nutrient and its role in preventing nutritional blindness is well established.*

*In recent years several intervention trials to test the effect of improving vitamin A status, including supplementation and fortification, have been implemented. Evidence has accumulated that in areas where vitamin A deficiency is a problem of public health importance, it also reduces mortality in infants in the second 6 months of life, and in young children although there are variations between communities and regions in the extent of impact.*

*Some of the reasons that may explain the differences in impact of vitamin A supplementation of mortality between studies include differences in:*

- a. Vitamin A status between communities, including diet;*
- b. Anthropometric (nutritional status) indices;*
- c. Exposure to illness and causes of death;*
- d. Access to health facilities, including immunization coverage;*
- e. Socioeconomic status, particularly literacy, affecting mothers and their children; and*
- f. Study design and implementation.*

*There are several possible strategies to ensure and sustain an adequate vitamin A status in all population groups, especially in young children. The choice of intervention is the prerogative of governments and should depend on specific country factors, including the severity of the vitamin A problem, the resources available, and national priorities for their utilization.*

## **IVACG SECRETARIAT REPORT**

The goal of IVACG is to control vitamin A deficiency and xerophthalmia (68). The IVACG Secretariat at The Nutrition Foundation, Inc., supports IVACG's major activities: organizing and convening international meetings, development and distribution of technical references, and building liaisons among those working against vitamin A deficiency.

A major goal of the XIV IVACG Meeting was to further define the practical applications concerning the role of vitamin A in child health and survival, which was the subject of the XIII IVACG Meeting. IVACG's international meetings bring together those who can contribute to successful control of vitamin A deficiency. Information from these meetings is distributed in the summary of each meeting; this information provides the stimulus for other new publications from IVACG.

Increasing demand for IVACG publications is one indication of the worldwide interest in solving the problem of vitamin A deficiency. Order fulfillment by the secretariat in 1991 represents more than a tenfold increase over the number of orders filled in 1987

(the beginning of the current Cooperative Agreement between The Nutrition Foundation, Inc., and USAID). Colleagues at other institutions assist with additional distribution of IVACG information.

Liaisons established through IVACG are the result of 16 years of collaboration and communication among investigators studying vitamin A worldwide. The XIV IVACG Meeting is one opportunity to foster liaisons. Other recent examples include IVACG's work with units of WHO and UNICEF to complete a new monograph on programs linking the distribution of vitamin A with immunization and efforts to promote practical applications of existing assessment methods with VITAL and other groups. IVACG continues to co-publish the *Xerophthalmia Club Bulletin* jointly with Sight Savers three times each year. This newsletter reaches more than 2800 readers. Through the IVACG Regional Representatives program, IVACG strives to increase information-sharing in the African region.

As a part of this report, the secretariat extended thanks to the many organizations and individuals who contributed to the success of the XIV IVACG Meeting.

#### **IVACG CHAIRPERSON: CLOSING REMARKS**

Dr. Abraham Horwitz summarized the highlights and lessons learned from the meeting (69). Participants were congratulated for the number and quality of papers presented and for the discussions that followed. The Ecuador meeting was distinct from other IVACG meetings in that it emphasized community-based interventions, an approach that represents a clear new step toward prevention. The process, by its own nature, will be slow but steady as we learn more about factors that influence family- and child-feeding practices. Although mothers are a clear target for improving the diets of children, we must also inform society at large about the role of a proper diet in maintaining a healthy life style. Effective nutrition education requires active participation of the people in understanding issues and making informed decisions about their health and nutritional well-being. A community-based approach, put forth more than a decade ago by the Alma Ata Declaration in launching primary health care, must underlie any success that is achieved in prevention and control of vitamin A deficiency.

Community-based interventions are highly diverse in nature. Presentations at the meeting described models that may prove to be generalizable in the future; these ranged from home-gardening to social marketing to efforts to reduce morbidity by any means possible, including vitamin A supplementation when indicated. Regardless of the form a strategy takes, effective management of resources and full local participation are critical so that more of what we know in nutrition can be applied successfully, in this case to prevent vitamin A deficiency.

Although experience with food fortification in developing countries is still limited, we should keep in mind that this approach has led to the virtual control of vitamin A deficiency in developed countries. Where feasible, it is the most cost-effective of all interventions. Greater feasibility should be apparent in the future as technological difficulties are overcome.

Mortality intervention studies presented at the meeting have reaffirmed the IVACG statement made after the XIII meeting in Nepal, "Evidence is accumulating that [vitamin A] also reduces mortality," taking note that one trial presented at the meeting did not show a significant difference in mortality. Research is urgently needed to elucidate more clearly the mechanisms by which vitamin A may reduce mortality. Our knowledge remains incomplete, although evidence presented at this meeting suggests that squamous metaplasia and various immune defects may underlie an increased risk of morbidity among vitamin A deficient children. The U.N. Subcommittee on Nutrition recognized the enormous policy implications of the relation between vitamin A and child mortality several years ago after the seminal observations of Sommer et al. (Sommer A, et al., *Lancet* 1983; ii:535-8; Sommer A, et al., *Lancet*, 1986; i:1169-73) were reported from Indonesia. At that time more studies were suggested, and we are now witnessing their fruition.

Methodology for assessment is advancing, with new techniques being developed and refined; these include impression cytology, variations on the relative dose response test, retinol-binding protein assays, and functional tests that relate to vision restoration and dark adaptation. Similar advances are being made in dietary assessment that include pictorial techniques and frequency-based methods. Validation of dietary assessment remains a major goal.

Information from international agencies on their activities assured us that prevention of vitamin A deficiency is a major program priority in many countries. Because reliable-time series data are frequently not available for individual countries, the information generated by vitamin A surveys from these agencies is valuable for monitoring progress.

Momentum to control vitamin A and other micronutrient deficiencies has never been greater, especially since the 1990 World Summit for Children at which heads of state from around the world committed themselves to eliminate these conditions over the next decade. The normative standards and humanitarian goals are clear. The task of controlling preventable malnutrition is daunting. "Although it has a price, the outcome is priceless, as it is precious. Children must not go blind or die prematurely because of lack of an essential nutrient such as vitamin A. This is our collective moral responsibility. As long as we keep it constantly in mind--what more poignant than the vision or the image of a child going blind--we will succeed." (A. Horwitz)

In closing the meeting, Dr. Horwitz thanked the Government of Ecuador, the Local Organizing Committee, and the IVACG Secretariat for their assistance in making this meeting a tremendous success. The XIV IVACG Meeting was then closed.

## **ACKNOWLEDGMENTS**

Many organizations and individuals contributed to the success of the XIV IVACG Meeting. The IVACG Secretariat wishes to acknowledge the essential support and contributions of groups in Ecuador, especially the Ministry of Health, Consejo Nacional de Desarrollo, UNICEF, the Pan American Health Organization, and the Local Committee for the XIV IVACG Meeting. They gave helpful advice throughout the meeting preparations and extended warm hospitality to meeting participants. The secretariat is indebted to Dr. Wilma Freire for her leadership and skill in coordinating the contributions from the host country. We also thank the VITAL project for assistance to the local committee and for facilitating the participation of many Ecuadorians.

Following the meeting, International Voluntary Services (IVS) in Chimborazo and the Institute for Development Cooperation Foundation (ICD) in Quito provided a chance

for participants to meet with community members and project organizers and observe activities of several community-based efforts in other parts of Ecuador. IVS and ICD generously and enthusiastically managed these visits.

Through their involvement with the IVACG Steering Committee, Dr. Frances R. Davidson, Dr. Demissie Habte, Dr. Abraham Horwitz, Dr. Norge W. Jerome, Dr. Vinodini Reddy, Dr. Franz Simmersbach, Dr. Alfred Sommer, and Dr. Barbara A. Underwood devoted many hours to maintaining the scientific quality of the meeting and endeavored to bring attention to programs and studies in the developing world. We appreciated their patience and encouragement throughout the months of planning. The secretariat thanks the 18 session chairpersons for their leadership during navigation of the full program. We are also grateful to the interpreters for the XIV IVACG Meeting, who carefully and tirelessly translated sessions into Spanish.

Dr. Keith P. West, Jr., and Dr. J. Peter Greaves, rapporteurs for this meeting, had the considerable task of synthesizing this report as a lasting document of the important presentations and discussions. Dr. Y.H. Yang volunteered to capture other dimensions of the meeting as the official meeting photographer. Through their efforts, these individuals help us to continue reflecting on the deliberations of the XIV IVACG Meeting.

Ecuaroche P.F.Q. S.A. (the F. Hoffman La Roche affiliate in Ecuador) welcomed us to Guayaquil during an opening night reception. Refreshments during the meeting and the meeting's closing events were sponsored by Atlantic Industries, Ltd. (the Coca-Cola Company in Ecuador). Both of these national organizations and their parent companies deserve much credit for contributing to the camaraderie of the week's events. Task Force "Sight and Life" of F. Hoffman La Roche, Ltd. was generous in its support for international participants. We also thank the Hotel Oro Verde Guayaquil staff for their excellent service and attention to our needs.

The IVACG Secretariat appreciates the cooperation, suggestions, and participation of colleagues around the world. We hope that the enthusiasm of this event will inspire them to apply ideas from the meeting toward achieving long-term solutions to the problem of vitamin A deficiency.



# **REFERENCES**

## **XIV IVACG Meeting**

## REFERENCES TO XIV IVACG PRESENTATIONS CITED IN TEXT

### Inaugurants

1. Dr. Plutarco Naranjo, Minister of Health, Ecuador  
Dr. Wilma B. Freire, Chairperson, Local Committee for the XIV IVACG Meeting and Director of Nutrition, CONADE, Ecuador
2. Dr. Omar Dary, Pan American Health Organization
3. Mr. Robert Kramer, Deputy Director, US Agency for International Development, Mission to Ecuador
4. Dr. Norge W. Jerome, Director, Office of Nutrition, Bureau for Science and Technology, US Agency for International Development
5. Econ. Jose-Carlos Cuentas-Zavala, UNICEF Representative, Ecuador
6. Mr. E. Gonzales-Regueira, Food and Agriculture Organization of the United Nations
7. Dr. Abraham Horwitz, IVACG Chairman

**Note:** The underlined name in each of the following references is that of the presenter. Explanation of symbols: † indicates that an abstract is included in this report; ‡ indicates that a paper is available from the secretariat. Abstracts of presentations received by the secretariat are included in this meeting summary. Many speakers provided manuscripts of their talks which are not included in this summary but are available upon request from the IVACG Secretariat.

### Keynote Speakers

8. Jonsson U. Essential components of successful community-based development programs. †
9. Underwood B. Community-based interventions for vitamin A deficiency. †
10. Freire W. Evaluation of the vitamin A status of Ecuador and programmatic implications. † ‡

### Community-Based Interventions

11. Moreano M, Davila S. Participacion comunitaria en la solucion de problemas de salud: Un caso de estudio. † ‡
12. Kothari G. Control of nutritional blindness in children through community participation. † ‡
13. Saenz de Tejada E. Intrahousehold food distribution - An anthropological approach. †
14. Flores H. The Caruaru Vitamin A Program: Has it been sustainable? †
15. Cruz JR, Bartlett A, Sibriah R, Kjolhede C. Child characteristics that influence voluntary participation in a vitamin A distribution program. † ‡
16. Heldt J-P, Sheffield VM, Schwab L, Barrows JM. Management concepts and issues for the prevention of nutritional blindness through efficient/effective planning and evaluation of community-based vitamin A programs in developing nations. † ‡
17. Yang YH. Training, the key to success of home-garden programs. † ‡
18. Bloem MW, Mulder M, Patwary Y, Paquette L. Distribution effectiveness of vitamin A capsules in disaster-prone areas of Bangladesh. †

19. Arthur P, Kirkwood B, Morris S, Ross D. Use of a daily illness diary in improving morbidity surveillance data within a field trial of vitamin A supplementation in northern Ghana. † ‡
20. Scott W, Haskell M. Patterns of availability, acceptance, and use of carotene-containing, domesticated vegetables and wild plants in three rural regions of Guatemala (Alta Verapaz, Santa Rosa, Zacapa). †
21. Ramana GNV, Vijayaraghavan K, Bamji MS, Reddy V. Horticultural intervention for improving vitamin A status. †
22. Reddy SK, Vyasa Rao S. The saga of inclusion of carotene-rich foods in children's diets. †
23. Talukder A, Bloem MW, Mulder M. Home gardening and consumption promotion aimed at combatting vitamin A deficiency in Bangladesh. †
24. Jalal F, Nesheim MC, Habicht J-P, Sanjur D (presented by Latham M). Effects of carotenoid-rich local diets, dietary fat intake, and deworming on vitamin A status of preschool children. †
25. Chandrasekhar U, Bhooma N, George B. Vitamin A nutriture of Indian preschool children and effect of supplementation with vitamin A-rich foods. † ‡
26. Aubel J. Assessment of alternative communication interventions for vitamin A. †
27. Klemm RDW, Villate E, Mendoza O. Integration of vitamin A supplementation and nutrition education into community health services: A case study. † ‡
28. Mahboob Ali M, Bloem MW, Mulder M. Social marketing to promote vitamin A awareness, consumption, and capsule distribution in Bangladesh. †
29. Smitasiri S. Social marketing of vitamin A-rich foods. † ‡

30. Renas R, Yongpanichkul S. Control of vitamin A deficiency in primary-school children through motivation communications and integrated farming in Nongkhai province. † ‡
31. Kodyat BA, McDivitt JA, Palmer AC, Reis TK, Satoto, Wilbur SE. The impact of social-marketing efforts on megadose vitamin A capsule coverage rates: Results of a pilot project in Central Java. † ‡
32. Van den Burg S. A pictorial questionnaire on vitamin A for Tarahumara Indian children in rural Mexico. † ‡
33. Kennedy E, Oniang'o R. Determinants of household and preschooler vitamin A consumption in southwestern Kenya. † ‡
34. Sommer A. Invited discussant of community-based vitamin A interventions. ‡
35. Kavishe F (Chair). Special evening session on community-based interventions. ‡

### **Perspectives on Vitamin A Fortification**

36. Latham M. Fortification: The most-promising, most-ignored intervention to control vitamin A deficiency. †
37. Wilbur SE. Fortification of monosodium glutamate in Indonesia. †
38. Dary O. Update on control of vitamin A deficiency in Latin America through sugar fortification. † ‡

### **Vitamin A and Childhood Morbidity and Mortality**

39. Herrera MG, Nestel P, El Amin A, Mohamed KA, Weld L, Fawzi W. Vitamin A supplementation of asymptomatic children, effects on morbidity and mortality: The Sudan experience. †

40. Binka FN, Ross DA, Dollimore N, Smith PG, Addy HA, Tomkins A. Vitamin A status in young children in the Upper East Region of Ghana: Baseline characteristics, Ghana VAST. †
41. Coutsoudis A, Broughton M, Coovadia HM. Morbidity consequences of measles treated with vitamin A or placebo in young African children. † ‡
42. West KP, Pokhrel RP, Katz J, Khatri SK, LeClerq SC, Shrestha SR, Tielsch J, Sommer A. Reduction of preschool child mortality by vitamin A in Nepal: A randomized, double-masked, community trial. †
43. Daulaire NMP, Pandey MR, Starbuck ES, Church MA, Stukel T, Houston RM, Pokhrel RP. Effect of a single high dose of vitamin A on mortality in a population with high childhood mortality and xerophthalmia rates. †
44. Semba R, Muhilal, Scott A, Natadisastra G, Wirasasmita S, Griffin D, Winget M, West KP, Sommer A. Immune status in children with mild vitamin A deficiency in Indonesia. †
45. Gonzaga NC, Anderson VM, Navarro EE, Quiapo SC, Tupasi TE. Squamous metaplasia in the respiratory epithelium of children who died of pneumonia. † ‡
46. Udomkesmalee E, Dhanamitta S, Charoenkiatkul S, Tantipopipat S, Banjong O, Rojroongwasinkul N, Kramer TR, Smith SC Jr. Effect of supplementation on vitamin A and zinc nutriture of children in Northeast Thailand. †
47. Martines J (Chair). Special evening session on vitamin A status and childhood morbidity and mortality. †

### **Update on Assessment Techniques**

48. Olson JA. Overview of techniques for assessing vitamin A status. † ‡
49. Tanumihardjo S, Muhilal, Olson JA. Assessment of marginal vitamin A status by use of the modified relative dose response (MRDR) assay. † ‡

50. Krause VM, Bulux J, Solomons NW, Delisle H. A pictorial checklist used by community-level health workers to estimate 7-day vitamin A intake of weaned preschool-age children in Guatemala. †
51. Monsour M. Strengths and limitations of using the IVACG simplified dietary assessment in Haiti. [Note: This is a title change from the program.] †
52. Rosen D, Sloan N. Back to basics: A low-budget approach to vitamin A problem assessment and program planning. † ‡
53. Sinawat S, Mahathanakhun R, Chitchumroonchokchai C, Kachondham Y, Thainues V. Prevalence of inadequate vitamin A nutriture in preschool children of the north and northeast Thailand. †
54. Sivakumar B, Panth M, Shatrugna V, Raman L. Beneficial effects of vitamin A supplementation in undernourished pregnant women. †
55. Olson J. IVACG Assessment Methodology Task Force Report. ‡
56. West C (Chair), Rosen D (Rapporteur). Special evening session on assessment techniques. ‡

### **Nongovernmental Organization (NGO) Presentations**

57. Ralte AL. Vitamin A in the community: A PVO perspective. VITAP, Helen Keller International. †
58. Garcia F. Critical elements in successful community-based vitamin A programming. World Vision Relief and Development, Inc. † ‡
59. Kothari G. Sight Savers.
60. Barrows J. International Eye Foundation. †
61. Gilbert C. Christoffel Blindenmission.

## Agency Presentations

62. Pena M. PAHO: Programs to control vitamin A deficiency in the Americas.
63. Simmersbach F. FAO: Communications projects for control of vitamin A deficiency. †
64. Davidson F. USAID: Vitamin A programs of the USAID Office of Nutrition. †
65. Cohen N. WHO: Integration of vitamin A distribution with immunization programs. † ‡
66. Guerney JM. WHO: Vitamin A regional network for Asia.
67. Greaves JP. UNICEF: World Summit for Children initiatives for control of vitamin A deficiency. †
68. Aomari LL. Report of the IVACG Secretariat. †
69. Horwitz A. IVACG: Concluding comments. †

**ABSTRACTS**  
**XIV IVACG Meeting**



THE VITAMIN A SITUATION IN ECUADOR. Wilma B. Freire, PhD, CONADE, Manabi y Vargas, Casa Vivanco 2do piso, Quito, Ecuador.

A national nutrition survey was carried out between March and November of 1986 on a sample of Ecuadorian children from 0 to 59 months of age. 1,570 children were selected in order to estimate the prevalence of specific deficiencies through the use of biochemical indicators and a consumption survey. An analysis of the data on vitamin A status revealed a prevalence of 14 percent when a cut-off point of <200 ug/L of serum retinol was chosen. When the population was divided into urban and rural residents, a higher prevalence was observed among rural children (16.4 percent, vs. 11.9 percent, respectively). In addition, a higher prevalence was found among boys than in girls; and among children who tested positive to the presence of infection, than to children with negative results. The analysis of consumption data demonstrate low levels of consumption of foods that are rich in vitamin A, and show that consumption is lower in the rural highland region as compared to the other regions. The data suggest that the Ecuadorian population may be facing moderate vitamin A deficiency. The consumption data collected in the survey support the biochemical findings, and indicate that the rural population in the highland region is at greatest risk.

DESARROLLO DE LA PONENCIA SOBRE

PARTICIPACION COMUNITARIA EN LA SOLUCION DE PROBLEMAS DE SALUD;  
UN CASO DE ESTUDIO.

Marcelo Moreano B., MD, Consejo Nacional de Desarrollo; Quito, Ecuador. Santiago Dávila C., MD, Salud y Sociedad (SYS); Quito, Ecuador.

RESUMEN:

Un barrio urbano marginal en Quito, Ecuador, fue seleccionado para el estudio. Seis mujeres fueron entrenadas como promotoras de salud. Trabajando como parte integral de un equipo de salud comunitaria con profesionales de salud, estas mujeres realizaron un censo socio-económico de las familias del barrio como también un diagnóstico de las condiciones sanitarias. Esta información fue utilizada para identificar la población a riesgo, los principales problemas de salud presentes en la comunidad, las condiciones bajo las cuales trabajaría el equipo de salud y la metodología para enfrentar esos problemas de salud. Para este propósito se empleó un modelo causal desarrollado por I. Beghin. Este modelo indica que el equipo de salud debe trabajar con los miembros de la comunidad para analizar las causas de uno de los mayores problemas de salud. Las causas son luego ordenadas de una manera jerárquica pesando la contribución que cada una de ellas tiene en el problema en conjunto. El problema que fue analizado es el de la desnutrición, cuyas mayores causas fueron identificadas como: falta de organización comunitaria, ausencia de educación nutricional, niveles bajos de ingresos familiares para la subsistencia e inadecuadas condiciones sanitarias. En el desarrollo del presente estudio fueron identificadas intervenciones adecuadas. Al momento, algunas de estas intervenciones que incluyen huertos familiares, educación para la salud y nutrición han sido desarrolladas y quieren ser replicadas en otras áreas con el fin de enfrentar ciertos problemas nutricionales, incluyendo la deficiencia de vitamina A.

**CONTROL OF NUTRITIONAL BLINDNESS IN CHILDREN THROUGH COMMUNITY PARTICIPATION. Dr. Gopa Kothari, Medical Advisor, Child Development Services, Sight Savers.**

The problem of malnutrition in children especially in rural areas and urban slums is quite common in India. The most widespread form of malnutrition in India is protein caloric malnutrition (P.C.M.) and such type of malnutrition in children in poor and socially disadvantaged communities is also closely linked with Vitamin A deficiency and blinding malnutrition in children.

The last few years have witnessed an increasing awareness on Vitamin A deficiency and child's nutrition as public health problem. The common factors identified are the inadequate consumption due to ignorance, social and cultural factors, non-availability, poverty and various childhood diseases.

The Government of India has implemented National Vitamin A Prophylaxis Programme since 1971 and have also started number of national nutritional programmes. At the end of 19 years even today the blinding malnutrition in children below six years is a problem. The failure of these programmes is mainly due to inadequate nutrition education and lack of community participation.

Sight Savers developed Xerophthalmia projects with an objective to prevent blinding malnutrition in children in India since 1981 in urban slums and rural areas.

The objective of the programme was to develop a community based programme which supplements existing primary health care structure with whatever is necessary to protect high risk children from blinding malnutrition. The projects were initiated to develop programmes based on local medical and social technology which results into cost effective and time bound methodology which can be replicable as a routine public health measure. It should generate community participation from the inception and later on can be continued as ongoing programme by the community through their own resources or by using existing infrastructure.

Building on the experience gained during the Xerophthalmia Programme, Sight Savers are now developing in India sustainable Integrated Child Development Services Projects (C.D.S.) in three locations at present. The three different approaches are the impact of folk media, female adult literacy and Integrated Child Development Scheme model of the Government and in non-scheme Urban Slum Area.

Tirupati C.D.S. Project in remote rural area demonstrates how effectively folk media (innovative approach to health and nutrition education) can be used to control the problem of Xerophthalmia and also a methodology to sustain such programme through community participation with existing Government infrastructure.

The projects in slum areas of Bombay at Dharavi, Damupada and Krantinagar slums are supported by Operation Eyesight Universal, (O.E.U.) The strategy developed is a primary health care approach with active community participation which has resulted into sustainable programme by community to control Xerophthalmia in Urban Slums.

**The Caruaru Vitamin A Program.  
A sustainable, community based initiative.**

H Flores, FACS Campos, MCNA Azevedo, MHCB Lins, SRMC Albuquerque, MBM Silva, RM Varela, AC Salzano. Department of Nutrition, Federal University of Pernambuco, 50739 Recife, PE, Brazil, and BA Underwood, National Eye Institute, National Institutes of Health, Building 31 - Room 6A-17, Bethesda, MD 20892, USA.

There is a long-standing need for vitamin A deficiency interventions in Brazil, specially in the Northeast. Our Department has gathered data to show that between 30 and 40% of children under five years of age present with low or dubious levels of serum vitamin A in this region. In 1985, the Mayor of Caruaru, a country city at 70 miles from Recife, sought our advice and technical-scientific support to implement a vitamin A program: universal distribution of 200,000 IU vitamin supplements to all children below 5 yr of age (half the dose for children aged below 1 yr). The program had two stages: a series of distribution rounds (a total of 8) where the population would take their children to receive the oral dose at 90 health posts distributed in the city and rural areas, and a second stage, where the children receive both the appropriate vaccine for their age (BCG: 0 to 28 d; polio and DPT: 2, 4 and 6 mo, and several times during the first 5 years of life; MMR: 5 mo, and measles: 9 mo, and booster doses at variable intervals) and the massive dose of vitamin A (100,000 IU up to one year of age and 200,000 IU thereafter). The evaluation carried out after the first four distribution rounds, along the first 18 months of implementation, showed excellent efficacy and efficiency: coverage increased steadily after every round, and all serum retinol levels below 1.05  $\mu\text{mol/L}$  disappeared, after the second round, in random samples of children. Coincidentally, the prevalence of low weight for age (below 75% of the standard), of anemia, of hypoproteinemia and of hypoalbuminemia dropped from 19, 50.9, 39.8 and 6 percent to 9, 14.5, 13.1 and 0 percent after the fourth round. Childhood mortality (1 to 5 yr of age), which trend showed a marked increase between 1983 and 1985 (3.4 to 5 per thousand), dropped to 1.7 per thousand in 1987. No systematic sociological or anthropological study was done to assess acceptance by the population, other than the very marked increase in coverage at each distribution round, but independent and random collection of opinions by a national TV station shows the mothers to be very satisfied with the program. As of 1991, the Program continues to be effective, despite major changes in the Central Administration of the city. As could be expected, coverage figures are not as accurate as during the "campaigns", which elicited a sense of "competition" in the City's Secretary of Health, due to the initial opposition of the State Secretary of Health. Indirect measures ("consumption" of vitamin A supplements and replacement of worn out dispensers, spot checks) indicate that coverage continues to be satisfactory. All costs of the program, save the vitamin supplements (donated by the Task Force Sight and Life), have been covered by the Caruaru "economic community" (banks, factories, stores). External input has been limited to the assistance of our Department. We believe that important elements of this program are: political backup (city authorities and international organizations such as IVACG), community involvement, universal design, inconspicuous participation of the University, and modesty of objectives: merely to improve the vitamin A nutriture of the target population using the pre-existing health delivery system.

FINANCIAL SUPPORT: grants REA-BR-3-85-49 (NAS/AID), 40.0039 and 500.552 (CNPq, Brazil), Project Hope (Fortaleza, Brazil), FACEPE (Pernambuco Foundation for the support of Science and Technology), Task Force Sight and Life and VITAL (Vitamin A Field Support Project).

CHILD CHARACTERISTICS THAT INFLUENCE VOLUNTARY PARTICIPATION IN A VITAMIN A DISTRIBUTION PROGRAM. Cruz, J.R., Bartlett, A., Sibrián, R., and Kjolhede, C. Institute of Nutrition of Central America and Panama (INCAP), Guatemala City, and The Johns Hopkins University, Baltimore, Maryland, USA.

A surveillance program aimed at determining the epidemiology of persistent diarrhea was carried out in Santa María de Jesús, a rural community in the highlands of Guatemala, from February 1987 to October 1989. Twice a week, field personnel visited the homes of 150-200 families with children 0-35 months of age to obtain information on morbidity (including diarrhea, cough, fever, signs and symptoms of acute lower respiratory infections). Additionally, weight and height of every child was monitored routinely.

During the course of this longitudinal study, a national program of distribution of vitamin A took place. Children over 5 months of age were eligible to take 200,000 IU of vitamin A in a single oral dose. Of the 152 eligible children participating in our surveillance program, approximately 62% took vitamin A.

Using the sociodemographic age, anthropometric and previous morbidity data available for each child and family, we evaluated and compared the characteristics associated with voluntary participation in this national vitamin A distribution program. The results of these analyses will be presented and discussed.

### INTRAHOUSEHOLD FOOD DISTRIBUTION - AN ANTHROPOLOGICAL APPROACH.

**E. Saenz de Tejada.** International Eye Foundation and Center for Studies of Sensory Impairment, Aging and Metabolism, Guatemala City, Guatemala.

Hypovitaminosis A has been recognized in Guatemala for the past four decades and a variety of strategies have been implemented to reduce this deficiency. Many interventions have not had sufficient impact as cultural aspects of the target population have not been taken into consideration in their plans. It was postulated that elimination of hypovitaminosis A at the community level would require a profound understanding of specific cultural attributes, namely those that condition availability and consumption of Vitamin A-rich foods, household preparation practices, and the intrahousehold distribution of those foods, and the acceptance of novel foods and public health interventions. The purpose of this investigation, then, was to obtain descriptive information on the basic cultural aspects of the food system by means of direct and structured observations in a sample of 60 households in a town, a village, a private and a communal plantation in the area of Yepocapa, Chimaltenango, in the context of the introduction of a Vitamin A-fortified specialty food, Nutriatol. Information was gathered on Vitamin A-rich foods available in the different ecosystems. It was found that tomatoes, eggs and bananas are available throughout the area and were served in any of the observed mealtimes more times than any other food. These three items were served less times in the communal plantation than in the other three sites. The accessibility of markets determine access to Vitamin A-rich foods or fortified products. In town there is a market every day and a "tienda" in every corner. People in the hamlet have to walk to town to the market and to obtain other services, but they also have a basic "tienda" at hand. The private and communal plantations obtain their products from ambulatory vendors that come once or twice a week and from one or two basic "tiendas". Availability among sources of green leafy plants (wild, cultivated or purchased) also varies from one community to the other. People in town purchase their greens; in the hamlet they purchase some and gather others; families in the private and communal plantations gather and cultivate their greens. The family member that feeds or supervises the young child at mealtime may determine the consumption of Vitamin A-rich foods. In all communities the household head's wife is the primary food-preparer and server. Daughters are the secondary food-preparers but not servers in all communities, although in the plantations the number of daughters preparing food is higher than in town and the hamlet. These women spend at least ten hours a day doing food related tasks. Meals are prepared in a greater variety of stoves in town, more so in elevated fireplaces, open "poyos" or covered "poyos" (mud stove). In the hamlet elevated fireplaces are more common, in the private farm they use elevated fireplaces and open "poyos", and in the communal plantation elevated fireplaces are more common. Nutriatol is a Vitamin A-fortified gruel. The attitudes and practices with respect to gruels would condition acceptance of the former. The majority of families in all communities serve atol regularly. Most believe that "atol" (gruel) is beneficial, gives strength and is good for health. The most common types of "atol" served in town, the hamlet and the private plantation are "masa" (corn gruel) and oatmeal. In the communal plantation "masa" and other "atoles" are served more frequently. Preparation practices of Vitamin A-rich foods is similar in the four communities. Green leafy plants are prepared by rapid boiling; tomatoes are broiled or boiled rapidly; eggs are boiled or fried; bananas are fried or eaten raw. Breast feeding is a common practice in the four communities; however, it was seen that children are breast fed up to their second year in town, up to their third year in the hamlet and the communal plantation and for a longer period of time in the private plantation.

The overall conclusions affirm the hypothesis that the application of cultural anthropological research methods and approaches, and specifically the technique of intradomestic structures meal preparation and mealtime observations have the potential to contribute insights on feeding behavior and food system that should be useful in the planning of sustainable programs for improving Vitamin A nutrition in areas endemic for hypovitaminosis A.

MANAGEMENT CONCEPTS & ISSUES  
FOR THE PREVENTION OF NUTRITIONAL BLINDNESS  
THROUGH EFFICIENT/EFFECTIVE PLANNING & EVALUATION  
OF COMMUNITY-BASED VITAMIN A PROGRAMS IN DEVELOPING NATIONS.

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Besides adequate funds and the availability of vitamin A, managerial competence is perhaps the single most important resource for the treatment and prevention of nutritional blindness in developing countries. Health professionals are needed to diagnose, teach, conduct surveys, and manage nutritional blindness programs in the Third World. Many highly competent health workers, however, trained to handle the biomedical and technical aspects of their profession, are often unprepared to assume managerial responsibilities such as the management of finances, personnel, equipment, and the preparation of timely statistical reports, among other critical issues. To that end, the purpose of our paper is to review the often overlooked managerial process, emphasize its centrality, and analyze common causes of success and failure.

**THE EFFECTIVENESS OF THE VITAMIN A CAPSULE DISTRIBUTION IN DISASTER PRONE AREAS IN BANGLADESH, Martin W. Bloem, Menno Mulder, Yeakub Patwary, Lyne Paquette. Helen Keller International./Bangladesh, P.O.Box 6066 Gulshan, Dhaka - 1212, Bangladesh.**

Since 1973 a national program has been in operation to distribute high potency vitamin A capsules (200.000 IU) semiannually to children aged 6-59 months. The distribution is carried out by NGOs as well as the Governmental Public Health System. With the data from the Nutritional Surveillance for Disaster Preparedness and Prevention of Nutritional Blindness we are able to evaluate the effectiveness of the distribution of the vitamin A capsules (VAC). The Nutritional Surveillance comprises bimonthly data collection from 7.000 to 10.000 children aged 6-59 months in some 17 disaster prone areas. Data is collected on the health and nutritional status of the children, the socioeconomic conditions of the households, and various distress factors.

The NSP has started in June 1990 and at the time of the XIV IVACG meeting the results from 6 rounds of data collection will be available. Current findings already showed that the coverage of the vitamin A capsule in the urban slums is about 90%. Consequently almost no nightblindness (0.2%) is found in these areas. In the rural areas, where NGOs reported to be working, the coverage is 60%, whereas in the non-NGO area the coverage is 42%. The point prevalence of nightblindness was respectively 0.70% and 1.96%. We found that the VAC coverage is the main responsible factor for the observed differences in the prevalence of nightblindness in various areas of Bangladesh.

The question now arises if the lower prevalence of nightblindness in NGO-working area is caused by just the higher coverage rate, better targeting, or both. Preliminary results suggest that the people in the NGO areas are on an average better off than their counterparts in the non-NGO working area. The capsules, however, tend to reach the better off population within both the NGO-working area and governmental area. If the data from following rounds will confirm this finding, the conclusion will be that, even with a targeting system which reaches only the better off population, a rise of 20% in coverage from an initial 40% is enough to reduce the prevalence of nightblindness below the cut-off point of 1% (WHO) for designating it a public health problem.

Furthermore, we found that education of the mother and to a lesser extent of the father was positively related with the prevalence of nightblindness. This relation is explained by an increased use of the vitamin A capsule services. No relation was found between the socioeconomic status of the household and the prevalence of nightblindness.

USE OF A DAILY ILLNESS DIARY IN IMPROVING MORBIDITY SURVEILLANCE DATA  
WITHIN A FIELD TRIAL OF VITAMIN A SUPPLEMENTATION IN NORTHERN GHANA.

Paul Arthur (Epidemiologist)<sup>1</sup>, Betty Kirkwood (Principal Investigator)<sup>2</sup>,  
Saul Morris (Statistician)<sup>1</sup>, David Ross (Study Director)<sup>1</sup>

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The Ghana VAST Child Health Study is a large scale field trial evaluating the impact of vitamin A supplementation on the incidence, duration and severity of childhood illnesses in an area of marginal vitamin A deficiency and high childhood morbidity. Using a double blind placebo controlled design, approximately 1000 children aged 6 - 60 months have been individually randomised to receive 4 monthly doses of vitamin A or placebo. Weekly home visits are made by trained fieldworkers to collect morbidity data using an interviewer administered questionnaire. This involves a detailed enquiry for the occurrence of 21 listed symptoms, signs or conditions. To obtain accurate information on illness duration, enquiry is conducted and separately coded for each day of the preceding week. Additional information is collected to enable a severity assessment of diarrhoea and a simple examination performed for the validation of reported respiratory illnesses. Such a weekly enquiry would be exhaustive and confusing for respondents. Not only would they need to remember if a particular condition had occurred, they would be required to specify which day(s) it occurred; a difficult enquiry to accurately answer for events occurring more than 3 days before the date of interview. To aid recall and to improve accuracy of illness reporting, an illness diary was introduced. A new diary is given each week to mothers. They are asked to mark for each day whether the child was healthy or suffered from any 3 conditions pictorially represented on the diary (diarrhoea, cough, any other illness). The diary is used at the weekly enquiry to prompt recall.

An evaluation of the use of the diary was conducted weekly for 4 weeks following its introduction. Data were collected on loss of diaries, whether completed and by whom, days omitted and inconsistencies on the record. Additional information was collected on mode of storage and the state of retrieved diaries and on the type of mark and writing material used. There was also a note for inconsistencies between the record and the weekly enquiry. This evaluation is being repeated at each dosing round. The data will be analysed for concordance with the weekly enquiry, and any changes in performance will be monitored. Experience so far shows that illiterate mothers can be taught to keep these diaries. They have generally been well kept and provide a good record of the health of the child over the period. It is the contention that simple diaries such as this can be developed for use in morbidity surveillance type studies in areas with very low literacy rates and that they add greatly to the quality of data collected.

TRAINING, KEY TO THE SUCCESS OF HOME GARDEN PROGRAM. Y. H. Yang,  
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Nutrition-oriented home garden program involves three major disciplines, namely, health/nutrition, education/extension, and agriculture/rural development. At the XIII IVACG Meeting in Nepal some countries with serious vitamin A deficiency including Indonesia, Bangladesh, and the Philippines announced their plan to pay increasing attention to horticultural approach in combating the nutritional disease.

However, the past endeavor to promote home garden program in most countries, though much resource was invested, did not produce expected result. Among different factors, weak training component of the program could be a major determinant.

It is understandable that the training should be multidisciplinary in nature and that, among the disciplines involved, agriculture/rural development should assume the major responsibility. Training in home garden program should cover the following groups of people:

1. National/regional project leaders, 2 months, at an international training center;
2. Project personnel at provincial level, 4 weeks;
3. Project personnel at county/city level, 12 days;
4. Project personnel at township level, 6 days;
5. Villillage leaders, 6-8 half day sessions.

The above training should be reinforced with periodic followup sessions/classes to introduce new idea and technology.

It is essential that, in developing training curriculum for different courses, a thorough understanding of the target area is a pre-requisite. Duties and responsibilities of the trainees and attitude, knowledge, and skills required should be clearly spelled out and "discrepancy approach" be applied. Motivation and organization of villagers and management and evaluation of program should be an integral part of the curriculum. At least half of the training time should be devoted in field work.

To strengthen the understanding of nutrition by related professionals and applying nutrition in their respective program, practical nutrition course should be introduced in agriculture, health, and teachers training schools. Orientation sessions for policy-makers should be conducted and program coordination mechanism be established, from national down to township levels.

Half-cooked and inappropriate training means no training, causing failure of the program and frustration of people. Training component could cost only less than 15% of total project cost, yet it is a determinant to project success. It is also an area that the project donor(s) could make best contribution.

**A SAGA OF INCLUSION OF CAROTENE RICH FOODS IN DIETS OF CHILDREN**

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For several years health care delivery by the Organisation included among other aspects, educating the population on increased consumption of Vitamin A foods. Surveys after a few years revealed fair knowledge existed among population of the desirability of consuming Vitamin A rich foods, but limited money available for food could not be expended on these relatively expensive items. Emphasis in education was therefore shifted from Vitamin A foods to the less expensive carotene rich foods (CRF). After some years, studies revealed even though recognition of value of CRF was good, diets still consisted of Cereal and small amount of vegetables, usually carotene poor vegetables. Study of factors leading to existing diets indicated poverty and poor availability of CRF, notably dark green leafy vegetables (DGLV) as being responsible. At this time bio-intensive gardens (BIG) received great emphasis as indigenous ingredients are used and comparatively little water required. Individual BIG projects were found unrewarding but did well in School Hostels. An alternative strategy of growing DGLV perennials requiring small space was tried. This found to result in increased DGLV in family pots, but did not figure adequately in child feeds. Study of reasons for this pointed to current life styles, child care patterns, deep rooted beliefs of harmfulness of DGLV to young children and traditional method of feeding children. Four villages matched for income, education, life styles, child care patterns and availability of DGLV selected. In two villages a concentrated effort to educate communities on a) imperative need to feed CRF to young children, b) harmlessness of DGLV to children and c) what, when, how much and how to prepare DGLV and introduce to children under taken. The other two villages served as Controls. Principle of education, current practice **plus DGLV**. Preliminary evaluation encouraging but some obstacles yet to be overcome.

## HORTICULTURAL INTERVENTION FOR IMPROVING VITAMIN A STATUS

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### ABSTRACT

Vitamin A deficiency is a major public health problem in India. Although massive dose vitamin A programme is in operation in several parts of the country, this is only an interim measure to reduce vitamin A deficiency. The ultimate solution to the problem lies in increasing the production and ensuring consumption of vitamin A rich foods in the community. Recently a community study has been initiated by the NIN, Hyderabad to evaluate the feasibility of this approach in 20 randomly selection villages in two districts belonging to different agroclimatic areas of Andhra Pradesh State. Results of the baseline survey revealed a high prevalence (4%) of Bitot spots among the preschool children indicating an urgent need for an intervention programme. A qualitative diet survey of children indicated that their diets are mostly vegetarian and generally lacked foods rich in vitamin A. Though most of the children received milk, the quantity was negligible as it is usually given in the form of tea. Consumption of eggs and meat was too little to have any significant nutritional impact. About a third of the households are already growing one or more vegetables or fruits either in their fields or homesteads. Lack of space and time, shortage of water were reported to be the most common reasons for not growing vegetables at home.

Based on these results, a Horticulture-cum-education intervention programme has been initiated in all the 20 villages surveyed. In each village 30 households with some vacant land for nutrition garden are selected and each household is provided with seeds/seedlings of plants which are good sources of  $\beta$ -carotene. Emphasis is laid on perennial and local varieties like amaranth, Indian spinach, agathi, papaya and drumstick. Village Assistants, one from each village, who are familiar with the local cultural practices, were selected and trained in various aspects of home gardening. They inturn motivate the womenfolk from the selected households to grow vegetables and fruits. In addition, an educational campaign has been started to create awareness in the community about the importance of vitamin A rich foods. Repeat surveys are conducted to evaluate the impact of the programme on the consumption of vitamin A rich foods. Preliminary results of the repeat survey will be discussed.

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**PATTERNS OF AVAILABILITY, ACCEPTANCE, AND USE OF CAROTENE-CONTAINING, DOMESTICATED VEGETABLES AND WILD PLANTS IN THREE RURAL REGIONS OF GUATEMALA (ALTA VERAPAZ; SANTA ROSA; ZACAPA).**  
**W. Scott, M. Haskell.** International Eye Foundation, Bethesda, MD, USA, and Guatemala City; and the Center for Studies of Sensory Impairment, Aging and Metabolism, Guatemala City, Guatemala.

The theme of this meeting of IVACG suggests a consensus around the notion that long-term, sustainable improvement in vitamin A status in regions of the world endemic for hypovitaminosis A will come from improved consumption of dietary sources of the vitamin. In Guatemala, 70% of vitamin A intake is from plant sources in the form of provitamin A carotenoids. Horticultural promotion, in the form of home gardens, is seen as the most culturally and economically consistent strategy. Given the variety of seasons, soils, climates, altitudes, and cultural beliefs and practices among the regions of Guatemala, we realized that a necessary step between the conception and the execution of a gardens-promotion project was a survey of past experience with and attitudes toward garden promotion, and the current consumption of green, yellow and orange plants, with an emphasis both on domesticated and indigenous (wild) species. Local community leaders and teachers had limited experience with garden programs, but were generally in favor of the hypothetical idea of initiating projects. The major forms of procurement of wild plants in the three regions were foraging and the marketplace, whereas vegetables came from the commercial purchase or home production. Regional differences were observed in reported consumption of both domesticated vegetables and wild greens, although there were also large areas of inter-regional homology. The arid province of Zacapa differed from the other two regions in selection of vegetables; the indigenous population of Alta Verapaz used a greater variety of wild plants than did the "ladino" groups in the other two localities. Within regions, acceptance patterns for carotene-containing foods differed along the urban-to-rural continuum. With previous community-level inquiry of this nature, both the planning for, and the anticipated acceptance of, horticultural promotions are likely to be benefitted.

**HOMEGARDENING AND CONSUMPTION PROMOTION AIMED AT COMBATTING VITAMIN A DEFICIENCY IN BANGLADESH, Aminuzzaman Talukder, Martin W. Bloem, Menno Mulder. Helen Keller International, P.O.Box 6066 Gulshan, Dhaka - 1212, Bangladesh.**

Homegardening can play a vital role in the prevention of nutritional deficiency and in particular of vitamin A deficiency. Theoretically small homegardens can produce enough vitamin A, amongst other nutrients, whereby rural families could meet their daily nutritional requirement.

In 1988, HKI initiated a pilot project on homegardening, working with 150 families of marginal and landless farmers. So far, the program has been very successful in developing the ability and skills of the farmers to cultivate vegetables on homestead land throughout the year and increase the availability of vegetables and fruits rich in vitamin A.

In August 1990, HKI has extended the program to 1.000 families, covering about 60 villages. The goal of this project is to increase the consumption of vitamin A rich food by young children, particularly of poor and landless families, through intensive agricultural extension and nutrition education. A set of adapted agricultural technology, including training, seeds, seedlings and production plan, has been developed during the pilot project. Special attention is given to soil types, seed availability, irrigation, composting, and local homegardening practices. A special effort will be made to find appropriate crops and to plan gardens in such a way that some vegetables can be planted everywhere around the house, e.g., on the roof, on not cultivable land near the ring well and near the road, without reducing the main cultivable land. Many alternative production plans will provide multiple choice to rural women, and the sale of seeds, seedlings, saplings and surplus vegetables will make them independent from external sources and supplement family income.

This program is focussing on mothers because they have primary responsibility for homestead gardening, they are the major decision makers in household consumption, and they are particularly responsible for the rearing of young children. Therefore, training programs have been developed on food preparation techniques, and nutritional knowledge. In general, we will encourage the use of vegetables in the diet by increasing her awareness on the importance of vegetable consumption for the health and nutritional status of particularly the young children.

The progress and success of the project will be assessed by monthly monitoring of the homegardening practices, consumption patterns, income gains, and the point prevalence of nightblindness of the young children. In addition, anthropometric measurements will be carried out in both a baseline survey and an evaluation study, to assess the impact on nutritional status of the young children. First results will be available in June 1991.

A COMMUNITY-BASED INTERVENTION TRIAL: EFFECTS OF CAROTENOID RICH LOCAL DIETS, DIETARY FAT INTAKE, AND DEWORMING ON VITAMIN A STATUS OF PRESCHOOL CHILDREN INFECTED WITH ASCARIS LUMBRICOIDES IN INDONESIA.

Fasli Jalal, Malden C. Nesheim, Jean-Pierre Habicht, and Diva Sanjur, Division of Nutritional Sciences, Cornell University, Ithaca, New York 14853.

Six groups of Ascaris lumbricoides infected children (N=259) from 4 villages consumed one rice based meal and snacks daily at supplementation centers for a 24-day period. The basic diet was supplemented in some groups of children with carotene rich local foods (as side dishes or snacks) and, or, with 25 grams of coconut fat per day. Some groups of children were also dewormed with levamisole. At baseline, the mean serum retinol levels of children in all treatment groups were similar and averaged below 20 ug/dl. Carotene rich foods significantly increased serum vitamin A levels of the children. The combination of dietary fat and deworming also had a significant effect on their serum retinol levels, and this was especially true among children whose initial serum vitamin A levels were below 20 ug/dl. When children were stratified into high and low infection density levels, using the mid point of the distribution of egg counts per gram feces among all children at baseline as a cut-off point, the results revealed that both the beta-carotene rich foods and the combined fat supplementation and deworming had a highly significant effect ( $p < 0.001$ ) on serum vitamin A levels of highly infected children, whereas among lightly infected children only the beta-carotene rich foods had a significant effect. These results indicate that low serum retinol levels can be improved either by supplementation with carotene rich local foods or by the combination of deworming and supplemental dietary fat.

**ASSESSMENT OF ALTERNATIVE COMMUNICATION INTERVENTIONS FOR VITAMIN A. Judi Aubele, B.P. 3746, Dakar, Senegal, VITAL Consultant.**

An assessment of nutrition communication interventions designed to promote improved vitamin A status was conducted by the VITAL project of the A.I.D. Office of Nutrition. The purpose of the assessment was to gather together the universe of experience in nutrition communication for vitamin A to highlight successful techniques and to identify the lessons learned.

The methodology used in the assessment consisted of review of available documentation on each of the 29 projects (including evaluation data), on-site visits to five of the projects, interviews with individuals responsible at headquarters level, and review of research in nutrition communications and education.

Given the diversity of the projects studied and the generally weak and limited project evaluation data available, it was not possible to systematically compare the projects using a set of standard criteria. Rather, 16 aspects of community vitamin A communications were identified and, to the extent possible, each of these aspects was examined for each project in terms of the appropriateness, effectiveness and sustainability of the approaches used. Based on this analysis, recommendations for each of these aspects of program development and implementation were formulated.

Four overlapping approaches to promoting improved vitamin A status were identified: community developments, institutional development, social marketing, and non-formal nutrition education. Although in many cases project evaluation data was weak and limited, the projects which appear to be most successful in the short term, and potentially more sustainable in the long term, are those which emphasize community development, non-formal nutrition education and institutional development approaches. Several of the projects which followed a social marketing approach and were well evaluated, appear to have been less successful in promoting the intended nutrition-related changes.

Other salient lessons learned include: the need for consistency between concept of communication and the operationalization of that concept in program activities; the importance of preliminary formative and baseline data collection; the need for clear program objectives; the value of integrating vitamin A activities into broader health and nutrition programs; the need for community participation at all levels of project development and implementation; the need to link vitamin A communications with efforts to increase production of vitamin A rich food sources; and the need for adequate monitoring and evaluation.

**INTEGRATION OF VITAMIN A SUPPLEMENTATION AND NUTRITION EDUCATION  
INTO COMMUNITY HEALTH SERVICES: A CASE STUDY.**

Dr. Manuel G. Roxas, Department of Health, Philippines; Mrs. Adelisa C. Ramos, Nutrition Service, Philippines; Mr. Rolf D.W. Klemm, Helen Keller International, Philippines.

A joint Department of Health (DOH) and Helen Keller International (HKI) project was initiated in 1987 to increase the coverage of vitamin A capsule supplementation among high-risk children and to increase the consumption of vitamin A rich foods among preschoolers. Selected strategies were (a) the integration of vitamin A supplementation and nutrition education into the existing health delivery system such as OPT, under-six clinic, EPI and home teaching; (b) building linkages between the DOH and NGOs to encourage xerophthalmia case detection, referral and dissemination of nutrition messages; (c) the application of social marketing techniques to promote the increased consumption of vitamin A rich foods. Results collected at endline indicated a significant overall reduction in xerophthalmia prevalence from 3.7% to 1.0%; significant increase in percent of targeted children who received vitamin A supplementation in the past 3 months from baseline (1.0%) to endline (24.4%); increases in all knowledge indicators among mothers; significant increase in average times per week households and children ate vitamin A rich foods; project interventions did occur as planned. Cross-sectional and monitoring studies provide strong support to the hypothesis that the project interventions made an important contribution to the observed reduction of xerophthalmia prevalence. The findings suggest that a carefully monitored VAC supplementation program combined with an intensive nutrition education program may lead to a significant improvement in the vitamin A status of children living in vitamin A deficient endemic areas.

A PICTORIAL QUESTIONNAIRE ON VITAMIN A FOR TARAHUMARA INDIAN  
CHILDREN IN RURAL MEXICO.

Sandra Van Den Berg, MPH. School of Public Health at the University of Texas Health Science Center. Ian Berger, MD, MPH. University of Houston.

A pictorial questionnaire was developed both as a tool to educate and to measure knowledge and attitudes about vitamin A rich foods for Tarahumara Indian children (aged 4-10) living in an isolated village in the Sierra Madre Mountains of northwest Mexico. This project was initiated after a vision screening by an international eyecare program (InFOCUS) revealed symptoms of Xerophthalmia due to vitamin A deficiency in young children.

The questionnaire consisted of a legal size paper divided into 36 boxes (9 rows by 4 columns) each of which contained a drawing. The pictorial questionnaire was part of a nutritional education program that included a formal presentation on vitamin A rich foods and visual aids. The questionnaire was administered to 50 schoolchildren before and after a formal presentation on vitamin A nutrition. During administration of the questionnaire, children were asked questions orally to which they had to respond by marking the box(es) that contained the drawing(s) representing the right answer(s). For analysis, answers to the questions were graded and given a score. Differences between answers were analyzed. This questionnaire shows an innovative way to teach and test knowledge of young children.

**ABSTRACT**

**DETERMINANTS OF HOUSEHOLD AND PRESCHOOLER VITAMIN A  
CONSUMPTION IN SOUTHWESTERN KENYA**

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A multi-year study from 1984 to 1987 was conducted in Southwestern Kenya to evaluate the effects of agricultural commercialization on household food security and preschooler health and nutritional status.

A representative sample of 617 households was selected for the study; preschoolers under the age of six (1,677) residing in these households were included in the study. Information on preschooler morbidity was gathered from a two week recall of incidence and prevalence of illness. Weights and lengths of preschoolers were measured eight times during the survey period. Results indicate that in households participating in the commercial agriculture scheme, incomes increased significantly.

However, the effects of increased household income on preschoolers energy and nutrient intake and nutritional status are modest. A doubling of household income would result in a 4% increase in caloric intake of the preschooler. Increased household income results in less diversity in the micro nutrient intake of the preschooler, including vitamin A, as compared to changes at the household level. Yet preschooler vitamin A dietary adequacy had a significant effect on decreasing the prevalence of total illness and total time ill with lower respiratory infection.

In order to eliminate caloric deficits and micro nutrient deficiencies in preschoolers in South Nyanza, broad based income generating schemes must be combined with complementary interventions aimed at improving the health/sanitation environment of preschoolers. The present study was used as the basis for planning and implementing an agriculture/nutrition linkages project in South Nyanza. The specific components of this current project are discussed.

THE IMPACT OF SOCIAL MARKETING EFFORTS ON MEGADOSE VITAMIN A CAPSULE

COVERAGE RATES: RESULTS OF A PILOT PROJECT IN CENTRAL JAVA.

Benny A. Kodyat, Head, Nutrition Directorate, Indonesia Ministry of Health; Judith A. McDivitt, Senior Researcher, Annenberg School for Communication; Anne C. Palmer, Grant Manager, Helen Keller International; Thomas K. Reis, Senior Program Officer, Academy for Educational Development; Satoto, School of Medicine, Diponegoro University, Indonesia; Steven E. Wilbur, Indonesia Country Director, Helen Keller International.

To combat vitamin A deficiency, the Indonesian Ministry of Health distributes megadose capsules to children 1-4 years old through the Village Health Post (Posyandu) system. In 1987, a vitamin A development project was launched to increase capsule coverage rates with communications interventions using a social marketing approach.

To assess the impact on capsule coverage rates of these on-going interventions in the project area in Central Java, data were collected in October of 1988 and 1989. For each round of data collection, samples of 500 intervention area mothers and 300 control area mothers were interviewed on their knowledge, attitudes, and practices regarding vitamin A capsules.

Results showed that the project activities had a positive impact. In the intervention area, vitamin A coverage of children 1-4 increased by two thirds, from 24.2% to 40.4% in communities with a Health Post point-of-distribution. In the control area, there was no change in communities with a Health Post. In communities without the Health Post point-of-distribution for capsules, the Project interventions did not affect capsule coverage rates.

SOCIAL MARKETING VITAMIN A-RICH FOODS. Suttilak Smitasiri, Head, Division of Communication, Institute for Nutrition, Mahidol University at Salaya, Thailand.

The Social Marketing of Vitamin A-Rich Foods Project is a district-wide pilot nutrition education study for the control and prevention of vitamin A deficiency in Northeast Thailand. Using community organization, media advocacy and social marketing concepts, it provides fundamental data on dietary status, behavioral and physical environmental factors affecting vitamin A-rich food consumption. It also tests the potential feasibility of a cost-effective, long-term program to prevent vitamin A deficiency amongst preschool and school age children, pregnant and lactating mothers. This presentation describes the project's problem context and overall development, purposes, hypotheses, design and educational methods, process and preliminary evaluation results. It highlights the value of a two-way concept of communication and problem-solving which is operationalized by establishing mechanisms for working with both institutional and community groups. Further, the project relies heavily upon an integrated, non-directive, decentralized approach to project development and implementation wherein institutional and community-level collaborators assume project ownership. Broad institutional and community development processes are supported through media and community interpersonal programs. Regarding results, this project is presently succeeding largely due to seven requirements, namely: 1) it views nutrition as an integrated behavioral and biomedical discipline; 2) considers issues of cultural, economic, political, psychological and physical environmental appropriateness; 3) uses a decentralized, intersectoral "bottom-up" "top-down" planning process, promotes community input at each stage, with specific objectives being assigned for each component of the campaign over time; 4) seeks to use nutrition education not only as a habit forming mechanism, but as a means for people to internalize nutritional knowledge and transfer it to other food items; 5) clearly defines audience segments and creates innovative and useful messages through formative research and pretesting which support well-paced behavioral changes; 6) utilizes creative media combinations, scheduling, and stimulating interpersonal communication to encourage a synergistic effect of multiple channels; and, 7) uses intersectoral feedback to monitor and evaluate the campaign's progress over time.

**SOCIAL MARKETING TO PROMOTE VITAMIN A AWARENESS, CONSUMPTION, AND CAPSULE DISTRIBUTION IN BANGLADESH, Mir Mahboob Ali, Martin W. Bloem, Menno Mulder. Helen Keller International/Bangladesh, P.O.Box 6066 Gulshan, Dhaka - 1212, Bangladesh.**

In 1989, nightblindness was found to be prevalent in 1.78% of Bangladeshi children aged 6-59 months. The infant mortality rate in Bangladesh is about 110 per 1,000. Accordingly to the recent findings on the relation between vitamin A deficiency and child mortality, vitamin A deficiency is thought to be an even greater problem now than it was 25 years ago.

Dark green leafy vegetables are the main source of vitamin A in Bangladesh. Bangladeshis, on an average, consume 46 gram of vegetables per day. The recommended intake is 200 gram. In addition, mothers observe to various extents a complex set of post-partum and lactation food taboos that restrict their vitamin A intake. Colostrum is generally withheld from infants, whereas dark green leafy vegetables are not introduced in the weaning practices before the second year.

These findings have led to the inclusion of the social marketing techniques by Helen Keller International/Bangladesh, resulting in a multi-media communication campaign. Social marketing promotes ideas and behavioral changes as well as product sales. It permits the development of carefully designed communications strategies that will be persuasive in the target setting, by identifying the resistance points.

The social marketing intervention is a persuasive communication campaign with the ultimate goal to increase the amount of vitamin A in the diets of young children and mothers through changes in feeding practices, dietary habits and supplementary vitamin A capsule distribution. The target population comprises pregnant women and lactating mothers, relevant family members, teachers, religious leaders, health workers and other resource persons for the people. The target audience participate in the campaign design, e.g., selection of the media, the illustrations, etc., through formative research. Thus, social marketing is both a bottom-up and top-down process. A combination of mass media (television spots, radio promotions, posters, leaflets), village promotion, demonstrations, and the health worker outreach is used to reach the target audiences.

The evaluation of this program is an ongoing process by which the communication strategy and means of implementation are continually monitored and fine-tuned to ensure maximum program effectiveness. The evaluation includes long-term quantitative study of accomplishments and behavioral changes.

CONTROL OF VITAMIN A DEFICIENCY IN PRIMARY SCHOOL CHILDREN THROUGH  
MOTIVATION COMMUNICATIONS AND INTEGRATED FARMING IN NONGKHAI PROVINCE.

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The goal of this project is to reduce and control vitamin A deficiency in primary school children. Integral with this goal is that a viable intervention strategy be developed which can be implemented as a long term solution to student malnutrition in Thailand. Technical and managerial support has been provided to teachers and students in 24 schools over a three year period by four NGO staff. Program areas are; agriculture (gardening, small animal raising), health education and motivation, training in signs and symptoms of malnutrition and utilization of school produce for school lunch programs. Through initial financial and continuing programmatic support a primary objective of the project is to build a system which will be self sustaining through the continued efforts of teachers and students after NGO input ends. Through evaluation by base line, mid-point and end-point surveys utilizing; serum retinol, impression cytology, dark adaptometry, clinical examinations, anthropometry, 24 hour dietary recall and KAP testing a quantitative assessment of the ability of the project to affect student nutrition can be applied towards measuring its application elsewhere.

Work pursuant to this project was supported by an USAID/Washington - Catholic Relief Services co-funded Grant No. DAN-0045-6-55-7105-00.

Technical consultations were provided by Institute of Nutrition, Mahidol University, Thailand and Department of Horticulture, Faculty of Agriculture, Kasetsart University, Thailand. Impact evaluation was performed by Institute of Nutrition, Mahidol University, Thailand.

FORTIFICATION: MOST PROMISING, MOST IGNORED INTERVENTION TO CONTROL VITAMIN A DEFICIENCY. M. C. Latham, Cornell Univ., Progr. Internat. Nutr., Ithaca, NY 14853

The 3 interventions most advocated to control vitamin A deficiency are (1) provision of medicinal supplements, (2) combined horticulture, nutrition education and health actions, and (3) fortification. These 3 strategies, combined with poverty reduction, should all be introduced in most countries. The only controlled study to compare the effectiveness, and cost, of these 3 strategies was conducted in Cebu Province in the Philippines (Solon, Fernandez, Latham and Popkin, 1979). It showed that fortification of MSG was more effective than either high dose capsule distribution or a PH/horticulture intervention. MSG fortification was judged to be the cheapest and most feasible of the 3 interventions for wider use. It was successfully introduced in Marinduque and Nueva Vizcaya Provinces (Latham and Solon, 1986). It was not adopted nationally. Rice fortification is now being investigated there. Influenced by the Philippines research, MSG fortification has been tested in Indonesia. In a controlled trial it was found to be related to better vitamin A status, improved child growth and reduced child mortality (Muhilal et al., 1988). Fortification of MSG, and other foods such as cereal grain products, oils and sugar, is a sustainable approach to improve vitamin A intakes. In contrast the provision of medicinal vitamin supplements to large populations will often require a very expensive delivery system, may lead to decreasing participation over time, and may miss the most needy children. It is an intervention better used widely within the PHC system. In the past most poor nations have sought a single food for fortification, whereas industrialized countries successfully, but unnecessarily, fortify hundreds of foods. Where vitamin A deficiency is a PH problem, efforts are now needed to fortify several commonly consumed foods. The market becomes the delivery system, the costs to the government and consumer will be low, legislation can ensure compliance, and above all the approach is sustainable. Other interventions will supplement its effectiveness.

**CONTROL OF VITAMIN A DEFICIENCY IN CENTRAL AMERICA THROUGH SUGAR FORTIFICATION. Omar Dary, Ph.D., Institute of Nutrition of Central America and Panama (INCAP)**

Nutritional status of vitamin A is still inadequate in all the countries of Central America, with the probable exception of Costa Rica. Currently, the control of this deficiency is approached through several means: promotion for production and consumption of vegetables and fruits rich in pro-vitamin A pigments, supplementation of preschool children with high doses of vitamin A, and sugar fortification with retinyl palmitate. Sugar fortification is considered as an intervention with fast results that will be applied until the natural diet fulfills the daily requirements of this nutrient. The effectiveness of the fortification to improve vitamin A ingestion was demonstrated during the 70's, when some of the Central American countries made the sugar fortification mandatory. However, the fortification process had a short life.

From 1988, INCAP has encouraged again the adoption of this practice, and it has worked in the improvement of the fortification technology and the quality control of the fortified sugar. To date, Guatemala has fortified during three years; El Salvador initiated this process last year; Panama is planning to begin it in 1991; and Honduras has fortified partially, even though the sugar producers asked to be exonerated to comply with the law because lack of foreign currency to purchase the required supplies. The permanence of the sugar fortification process depends on the overcoming of the limitations that made it to fail in the past: shortage of economical resources, and lack of governmental mechanisms to enforce the law.

## **Vitamin A Fortification of MSG in Indonesia: An Update.**

**Steven E. Wilbur, Country Director, HKI Indonesia and Dr. Benny A. Kodyat, Director, Directorate of Nutrition, Ministry of Health**

**Background.** Vitamin A deficiency remains a major public health problem in Indonesia. The Ministry of Health employs a three-pronged strategy to solve the problem with Vitamin A capsule distribution as a short-term solution, fortification of MSG as an interim solution and dietary behavioral change as the long term solution. Helen Keller International, through assistance from USAID and other donors, has been working with the Ministry of Health to perfect the technology and methods to reach pre-school children with Vitamin A fortified MSG. In the mid-1980's, a limited field trial was implemented in West Java which demonstrated the biological efficacy of MSG fortification. Children in the intervention group had significantly lower incidence of Bitot's spots and significantly higher blood serum Vitamin A levels than the control group.

**Methodology.** With the efficacy of fortification demonstrated, in 1987 a pilot fortification program was started to deal with the technical, managerial and political problems of a large-scale intervention. A Vitamin A product was developed that was white-coated, resistant to moisture, dissolvable in food, easily absorbed by children, inexpensive and religiously acceptable. Politically, questions of MSG suitability and involvement of MSG manufacturers were resolved. Managerially, a field trial was started in June 1989 distributing fortified MSG to 3 districts with 1.5 million people, providing children with half the minimum RDA of Vitamin A.

**Problems and Solutions.** Within two months of field distribution, the white coating broke down, releasing the Vitamin A. Field trials were halted. An improved white coating was developed, but Vitamin A potency was found to drop dramatically after 2-3 months. A new series of Vitamin A prototypes were then developed with substantially improved stability. Presently, small-scale Indonesian field trials are underway with two new promising prototypes. The most successful will be tested on a larger scale before resumption of the 3 district, 1.5 million people trial. Simultaneously, cost recovery mechanisms are being planned so that the consumer will absorb the small additional costs for these increased benefits. With no further technical problems, fortification could be ready for large-scale implementation in late 1993.

**Summary;** The MOH is strongly committed to this project for the following reasons: capsules will not reach all of the at-risk population; MSG reaches 95% of all children on a regular basis; it requires no behavior change by the consumers; it uses existing delivery systems and there would be little cost to the government. In general a successful fortification program will require a proper vehicle for fortification, political commitment, incremental development with careful monitoring, a good technical problem-solving team and a cost recovery mechanism.

VITAMIN A SUPPLEMENTATION OF ASYMPTOMATIC CHILDREN, EFFECTS ON MORBIDITY AND MORTALITY. M.G. Herrera,<sup>1,2</sup> Alawia El Amin,<sup>1</sup> Kamal Ahmed Mohamed,<sup>1</sup> Penelope Nestel,<sup>1</sup> Leisa Weld,<sup>1</sup> Wafaie Fawzi.<sup>1</sup>

A double blind, randomized trial was conducted in Northern Sudan to ascertain the effects of Vitamin A administration on infectious disease morbidity and mortality. Baseline socio-demographic, anthropometric, morbidity and dietary intake assessments were used to test the comparability of treatment groups. At the time of the initial survey, preschool children were randomly assigned by household to one of two treatment groups: 1) 200,000 IU Vitamin A and 40 U Vitamin E every six months 2) 40 U Vitamin E every six months. Any child with signs or symptoms of Vitamin A deficiency was treated and excluded from the study. Follow up visits were carried out every 6 months to administer the vitamin capsules and to repeat the morbidity and anthropometric measurements. A sample of approximately 30,000 subjects was enrolled and followed for a period of eighteen months. At the time of the last visit, all children received 200,000 I.U. Vitamin A. The results of the intervention on mortality, morbidity and nutritional status will be presented.

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**Reduction of Preschool Child Mortality by Vitamin A in Nepal: A Randomized, Double-masked Community Trial. Keith West, RP Pokhrel, Joanne Katz, SK Khattri, Steven LeClerq, SR Shrestha, JM Tielsch, Alfred Sommer. Dana Center for Preventive Ophthalmology, Wilmer Eye Institute, Johns Hopkins University, Baltimore, MD, USA and the National Society for the Prevention of Blindness and the Nepal Eye Hospital, Kathmandu, Nepal.**

A randomized, double-masked, placebo-controlled community trial was carried out in rural Nepal to assess the efficacy of periodic, community-based delivery of vitamin A in reducing child mortality. Two hundred and sixty-one communities (wards) in the District of Sarlahi participated. A total of 28,630 children 6 to 72 months of age were given either 200,000 IU (60,000 ug RE) or 1000 IU (300 ug RE) of vitamin A in capsular form once every 4 months for up to a year. Antecedent mortality rates and baseline characteristics were nearly identical in both treatment groups. The prevalence of xerophthalmia was 3.0% in both groups at the outset of the trial. More than 90% of children in both groups received a capsule at each cycle; 74% received their entire quota. Annual mortality rates were 11.5 vs 16.4 deaths per 1000 child-years in the vitamin A and control (low-dose) supplement groups, respectively. The protective relative risk (RR) was 0.70 (95% confidence interval: 0.56 to 0.88), equivalent to a 30% reduction in mortality. The greatest impact was observed after the first distribution cycle (RR=0.76) with the apparent effect stabilizing after the second and third 4-month cycles (RR=.67). The reduction in mortality was apparent in both sexes and at each age, irrespective of acute nutritional status, season, or area of residence. Improving vitamin A nutriture in a vitamin A deficient pediatric population can substantially reduce preschool child mortality. Periodic delivery of vitamin A in the community offers one way to rapidly achieve this goal until more sustainable, dietary solutions are effectively in place.

**EFFECT OF A SINGLE HIGH DOSE OF VITAMIN A ON MORTALITY IN  
A POPULATION WITH HIGH CHILDHOOD MORTALITY AND XEROPHTHALMIA RATES**  
Nils M.P. Daulaire MD MPH (INTERCEPT, Hanover NH 03755)

Periodic supplementation of all children under the age of five with high dose Vitamin A capsules (50,000 IU under 6 months, 100,000 IU 6 to 11 months, 200,000 IU 12-59 months) was initiated in Jumla, a remote mountainous district of western Nepal, using community-based agents already in place. Complete vital events registration was already underway as part of an earlier pneumonia intervention trial and had documented a baseline infant mortality rate of 189 and a 1-4 death rate of 52. A xerophthalmia survey carried out at the time supplementation was begun found a xerophthalmia rate of 13.2% among children 0-59 months old.

During the phase-in period (5 months), villages comprising 3,794 children between birth and 59 months of age received supplementation; in the subsequent round and all ensuing rounds all children in the district were covered. Observation of child mortality continued in these villages during this initial five month period, as it did in not yet supplemented villages comprising 3,421 under fives with a statistically comparable child mortality baseline prior to supplementation. During this period, mortality among children 1-59 months was 26% lower among children in supplemented villages than among those not yet supplemented (protective relative risk 0.74, 95% confidence interval 0.55-0.99,  $P < .05$ ). There was no apparent difference in mortality among children under 6 months of age (RR 0.99, CI 0.41-2.41), with all the mortality difference observed among children 6 to 59 months. The strongest age effect was seen in children 6 to 11 months (RR 0.51, CI 0.30-0.89), and differences were also noted in each age category from 12 to 59 months. Protective relative risk was similar for boys and girls (RR 0.72, CI 0.48-1.08; RR 0.76, CI 0.48-1.19, respectively). Among various causes of mortality, the greatest observed effect was on diarrheal deaths, with a lesser effect on pneumonia deaths and a small effect on measles deaths.

These observations of differences during a phase-in period support earlier studies linking vitamin A supplementation with decreased child mortality. They indicate that even a single high dose of vitamin A can have a sizable and significant mortality impact in a population of children with high underlying mortality and xerophthalmia rates, especially if provided just prior to seasonal diarrheal mortality peaks. Such an effort was found to be programmatically straightforward, required only limited resources, and should be readily replicable.

THE VITAMIN A STATUS OF YOUNG CHILDREN IN THE UPPER EAST REGION OF GHANA.

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The baseline results of the Ghana Vitamin A Supplementation Trial will be presented, with emphasis on the vitamin A status of the young children in the Upper East Region of Ghana. These results were obtained in two separate, but linked cross-sectional surveys. In the first survey, 15,389 children aged 0-6 years old were screened for suspected xerophthalmia by specially trained lay fieldworkers between September and December 1989. All children with nightblindness (problems seeing in the evening, but no problems seeing during the daytime) were recorded, while the fieldworker referred any child who had either a suspected Bitot's spot or corneal abnormality to one of the study physicians, who either confirmed the diagnosis of suspected xerophthalmia or not. 148 (0.962%) of the children had nightblindness, 2 children (0.013%) seen by the physician had Bitot's spot, 2 (0.013%) had unilateral corneal ulcers and 7 (0.045%) had corneal scars of which 3 (0.019%) were bilateral. In the second survey in an adjacent area 1179 children aged 0-4 years old were screened by a fieldworker and a physician between April and June 1990. In this survey, the fieldworker screened the child for nightblindness, but all the children were screened for eye signs of xerophthalmia by the physician. 27 (2.290%) of the children had nightblindness according to the fieldworker, while 1 child (0.085%) had a Bitot's spot, and 2 children (0.169%) had unilateral corneal scars. A subsample of 651 (4.2%) and 1177 (99.8%) of the children in the first and second cross-sectional surveys respectively, had blood samples taken for serum vitamin A levels, and at least one conjunctival impression was taken from 497 (3.2%) and from 898 (76.2%) respectively, for impression cytology. The results of the serum vitamin A estimation and conjunctival impression cytology will also be presented.

**MORBIDITY CONSEQUENCES OF MEASLES TREATED WITH VITAMIN A OR PLACEBO IN YOUNG AFRICAN CHILDREN. A. Coutsooudis, M. Broughton, H.M. Coovadia, Department of Paediatrics & Child Health, University of Natal, P.O.Box 17039, CONGELLA 4013, South Africa.**

Sixty African children of poor socio-economic background with diarrhoea and pneumonia complicated measles severe enough to warrant hospitalisation were randomly assigned to receive either high dose oral vitamin A (n = 29) or placebo (n = 31) in a double-blind trial. The two groups of children (4-24 months of age) had similar management in the wards e.g. antibiotic treatment and diet. Serum retinol, vitamin E, Zn, retinol binding protein (RBP) and pre-albumin were measured on days 1, 8 and 42.

At baseline the two groups were comparable in known covariants of measles severity: weight/age entiles; overcrowding; rash; total lymphocytes; serum levels of Zn, albumin, pre-albumin, RBP, retinol and vitamin E. On admission 90% of the children had hyporetinemia although clinical signs of vitamin A deficiency in the community are rare. Zn, RBP and pre-albumin were also significantly reduced compared to healthy controls. On day 8 these levels had returned to normal values; serum retinol levels in the supplemented group were significantly increased compared to the placebo group. Of the 29 vitamin A treated children 28 (96%) had recovered fully within 7 days compared to 11 of the 31 placebo patients (65%);  $p = 0.002$ . There was one death in the placebo group. Integrated Morbidity Scores (IMS) derived from diarrhoea, herpes and respiratory tract infection (radiologically confirmed) were assigned on day 8, at 6 weeks and 6 months - these were reduced by 82%, 61% and 85% respectively in the supplemented group; this was mainly due to reduced respiratory tract infection. At 6 weeks weight gain was significant in the supplemented group.

Despite the selected sample, attention to multiple covariates and stringent inclusion criteria, enhances the validity of the data obtained and supports the current WHO recommendations for vitamin A supplementation during measles. In addition our results suggest that hyporetinemia during measles is the consequence of temporary impaired mobilisation and therefore in addition we recommend that vitamin A should be given to all children with severe measles even in communities where vitamin A deficiency is not a recognised public health problem.

IMMUNE STATUS IN CHILDREN WITH MILD VITAMIN A DEFICIENCY IN INDONESIA. R. Semba, Muhilal<sup>1</sup>, A. Scott, G. Natadisastra<sup>2</sup>, S. Wirasasmita<sup>2</sup>, D. Griffin, M. Winget, K. West, A. Sommer. Dana Center and the Johns Hopkins Medical Institutions, Baltimore, U.S.A., <sup>1</sup>Nutrition Research and Development Centre, Bogor, Indonesia, <sup>2</sup>Cicendo Eye Hospital, Bandung, Indonesia.

Immune dysfunction is hypothesized to account for the increased morbidity and mortality observed in mild vitamin A deficiency. A randomized, double-masked, placebo-controlled clinical trial was carried out with 236 preschool children, age 3-6, in Indonesia to assess immune status in vitamin A deficiency. Clinically normal (n=118) and xerophthalmic (n=118) children were matched by age and sex and randomized to oral vitamin A, 200,000 IU, or placebo. Tetanus, oral polio, and inactivated intranasal influenza vaccines were administered two weeks later. Antigen-specific antibody responses were measured by ELISA. Cell-mediated responses to tetanus and mitogen were measured by lymphocyte blastogenesis. T cell subsets (CD2, CD4, CD8, CD45) were measured by flow cytometry. Results demonstrate that both clinically normal and xerophthalmic children who received vitamin A had higher humoral IgG responses to tetanus than children who received placebo. No humoral IgG or IgA responses to polio were observed in any children. Children who received vitamin A appear to have greater lymphocyte blastogenesis responses to tetanus. T cell responses to mitogen were normal in all allocation groups. The implications of these findings and other work in-progress will be discussed.

EFFECT OF SUPPLEMENTATION ON VITAMIN A & ZINC NUTRITURE OF CHILDREN IN NORTHEAST ( NE) THAILAND.

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Previous surveys of the nutritional status of young children in NE Thailand suggested that they may benefit from vitamin A (VA) and/or zinc (Zn) supplementation (Am. J. Clin. Nutr. 52:564-7, 1990). Design: 140 children, 6-13 y, with low plasma retinol (<30 ug/dl) & Zn (<80 ug/dl) concentrations were entered in a double-blind study. They were randomized & supplemented with either VA (5000 IU/d), Zn (25 mg/d), VA + Zn or placebo each weekday for 6 mos. All subjects consumed their usual diet that provided adequate protein, less than recommended calories, fat, Zn & VA. Results: Biochemical indices of VA (plasma VA, retinol-binding protein) & Zn status (plasma Zn, alkaline phosphatase) increased significantly. The children had adequate VA liver stores as assessed by relative dose response (<20%). Zn supplementation resulted in improvement of vision restoration time in dim light using rapid dark adaptometry. VA & Zn synergistically normalized conjunctival epithelium after a 6 mo supplementation. Conclusion: Data suggest that functional improvements of populations with suboptimal VA & Zn nutriture can be accomplished by supplementation with <2 times of RDA of these nutrients. We propose that these quantities could be provided by a food supplement high in both nutrients. Supported in part by The Royal Thai Government, U.S. Agency for International Development, and the U.S. Department of Agriculture.

OVERVIEW OF TECHNIQUES FOR ASSESSING VITAMIN A STATUS.

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Vitamin A status can be divided into deficient (D), marginal (M), satisfactory, excessive, and toxic states. Useful conventional indicators of D & M states include eye signs, e.g. Bitot's spots, and low mean plasma vitamin A values in selected populations. Night blindness can be assessed in some cultures by interviewing the mother. A new procedure, the vision restoration time (VRT), and the rapid dark adaptation time (RDAT) assay can determine other visual abnormalities. Because vitamin A is required for the differentiation of normal epithelia, reduced Goblet cell formation and abnormal epithelial cells in the eye are the basis of a relatively new indicator, conjunctival impression cytology (CIC), with or without transfer. Because serum vitamin A levels can be affected by factors other than vitamin A status, a group of response assays have recently been developed. Thus, a large dose of vitamin A can shift the distribution curve of initial serum retinol values after a week or month. Shorter term response assays (3-10 hours) include the relative dose response (RDR), the modified relative dose response (MRDR), in which 3,4-didehydroretinyl acetate is given, and the holo-retinol-binding protein relative dose response (RBP-RDR). A valuable new development in dietary assessment is a simplified food frequency (SFF) method that also includes an important pedagogic aspect. (Supported by the Thrasher Research Fund 2800-8, USDA-87-CRCR-2320, & NIH-32793.)

ASSESSMENT OF MARGINAL VITAMIN A STATUS BY USE OF THE  
MODIFIED RELATIVE DOSE RESPONSE (MRDR) ASSAY.

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Vitamin A status can be categorized as follows:  
deficient, marginal, satisfactory, excessive, and toxic. An  
increased morbidity and mortality has been associated with  
children in a marginal status. Methods of assessing a  
marginal status include the relative dose response (RDR),  
MRDR, conjunctival impression cytology (CIC), rapid dark  
adaptation time (RDAT), the vision restoration time (VRT),  
and isotope dilution assay. In using the MRDR in children,  
we have found: 1) that a single blood sample is much easier  
to obtain than >1, 2) that the need for HPLC analysis is not  
critically limiting, 3) that the MRDR values accord with  
other information about vitamin A status in a given region,  
4) that the MRDR response is independent of mild protein-  
calorie deficiency, 5) that a dose (50,000 IU) of vitamin A  
causes abnormal MRDR values to become normal, and 6) that  
intra-individual variations in the MRDR are small in vitamin  
A-sufficient individuals, i.e. repeated tests give similar  
values in the normal range (0-20%). Thus, the MRDR test is  
a useful procedure, and may well be the method of choice, in  
assessing the vitamin A status of individuals and of  
populations. (Supported by the Thrasher Research Fund 2800-8  
and 2806-6, USDA-87-CRCR-2320, and NIH-NIDDK 32793).

PREVALENCE OF INADEQUATE VITAMIN A NUTRITURE IN PRESCHOOL CHILDREN OF THE NORTH AND NORTHEAST THAILAND. Sinawat S, Mahathanakhun R, Sithisingh U, Chitchumroonchokchai C, Kachondham Y and Thainuea V. Division of Nutrition, Department of Health, Ministry of Public Health, Bangkok and the Institute of Nutrition, Mahidol University at Salaya, Nakhon Pathom, Thailand.

A survey of inadequate vitamin A nutriture in preschool children of the North and Northeast Thailand was conducted during the dry (Feb-Mar, 1990) and rainy season (Sep-Oct, 1990). Five districts in each region with the highest prevalence of protein energy malnutrition were chosen. A total of randomly-selected 996 children aged 2-6 years, participated in the survey. All children received anthropometric measurement, clinical examination including signs of xerophthalmia and blood drawn for serum retinol analysis. The relative dose response (RDR) test and conjunctival impression cytology (CIC) were performed in 20% of the population.

Prevalence of malnutrition as determined by weight/age, height/age and weight/height improved slightly in rainy season compared to that of the dry period. No signs of Bitot's spot or keratomalacia were observed. Approximately one percent of the population during both periods exhibited serum retinol concentration below .35 umol/L. Serum retinol between 0.35-0.70 umol/L were found in 14 and 7% of the population in the dry and rainy seasons respectively. Estimation of liver vitamin A by RDR indicated depleted stores in approximately 20% of the children. Positive RDR (RDR > 20%) can be found in children with serum retinol as high as 1.5 umol/L. In addition, children on the average of 18% showed abnormal CIC. The magnitude of the problem estimated by RDR corresponded well with that of CIC, thus allowed for the ranking of high-risk and low-risk areas in each region. The North and Northeast provinces showed relatively similar degree of vitamin A deficiency according to serum retinol concentrations, RDR and CIC.

In summary, the survey indicated that approximately one-fifth of preschool children in the North and Northeast Thailand experience subclinical vitamin A deficiency. The survey also identified the high-risk areas for future nutrition action program to increase intake of vitamin A among the target population.

THE VALIDITY OF A PICTORIAL CHECKLIST USED BY  
COMMUNITY LEVEL HEALTH WORKERS TO ESTIMATE 7-DAY VITAMIN A  
INTAKE OF WEANED PRE-SCHOOL AGE CHILDREN IN GUATEMALA

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Assessment of vitamin A intake is a challenging difficulty which complicates the study of determinants of vitamin A status and the evaluation of the impact of vitamin A-related interventions. Recognizing a need to adapt dietary assessment tools and methods to be suitable for use by community-level health workers in community-based interventions, this project sought to develop and test the validity of a dietary tool called a "Pic-check". The Pic-check is a pictorial checklist including a series of photographs of vitamin A-containing foods, selected along the guidelines proposed by IVACG (1989). Intended to be used by community-level health workers in interviewing child care-takers, the objective of the Pic-check method is to semi-quantitatively estimate the vitamin A intake of weaned pre-school age children, over a seven day period. The validity of the Pic-check method was assessed as follows: for seven consecutive days, the total dietary intake of the child was weighed. On the eighth day, the child's care-taker was interviewed using the Pic-check, to estimate the child's vitamin A intake during the previous seven days. The validity of the Pic-check method was assessed by comparing (a) the estimate of vitamin A intake obtained with the Pic-check and (b) the measurement of vitamin A intake obtained by weighing the child's food intake over the same seven day period. It is hoped that this type of dietary assessment tool will permit increased community level participation in Vitamin A-related interventions.

This project was in part funded by a scholarship to VMK from the Canadian International Health Society.

**COMBINED 24-HOUR RECALL AND FOOD FREQUENCY SURVEY IN ASSURING VITAMIN A INTAKE AMONG PRESCHOOL CHILDREN: THE CASE OF HAITI. Mohamed Mansour, Save The Children Federation, 54 Wilton Road, Westport CT and Deborah Barnes, Haiti Child Health Institute, Port-au-Prince, Haiti.**

A baseline survey of vitamin A nutritional status was carried out on a random sample of approximately 1,000 preschool children in the Maissade Impact Area, where Save the Children operates a community-based health and rural development program. This survey of the vitamin A intake of preschool children was conducted using a modified IVACG simplified dietary assessment methodology. Focus group interviews with health workers (male and female) and mothers were used to provide insight into infant and child feeding practices and community recognition of clinical vitamin A deficiency. A 24-hour dietary recall validated by observational study on a preselected sample of preschool children provided quantitative information on daily meal plans and usual portion sizes. The vitamin A content of commonly consumed food was calculated from appropriate Food Composition Tables. Finally, a combined 24-hour recall/food frequency survey for the previous month was conducted among a random sample of 176 preschool children, using female health workers who had been trained for nine months in primary health care and nutrition. Survey data results differed for each of the techniques and the methodological issues pertaining to each are discussed. Beyond the primary purpose of identifying children at risk for vitamin A deficiency, this research is useful in the development of a simple tool to monitor consumption of vitamin A-rich foods on a routine basis, by appropriately trained community health workers. Quarterly data on vitamin A intake by preschool children, pregnant and lactating women will be used to show changes in consumption patterns in response to nutrition education and vegetable gardening activities.

**BACK TO BASICS: A LOW BUDGET APPROACH TO VITAMIN A PROBLEM ASSESSMENT AND PROGRAM PLANNING.** David S. Rosen, Dr. Nancy Sloan, Vitamin A Technical Assistance Program (VITAP), Helen Keller International, 15 W. 16th Street, New York, New York, 10011, USA.

The scarcity of reliable epidemiologic data on vitamin A deficiency in developing countries is a reality that agencies involved in vitamin A deficiency control programs must face. In the absence of reliable quantitative data, and given limited technical and financial resources, what steps can be taken to assess the likelihood of vitamin A deficiency in a project area for the purposes of program planning and resource allocation?

By combining qualitative and semi-quantitative data collection methods, we suggest that it is possible to develop a profile of vitamin A deficiency for the purposes of 1. determining whether a vitamin A deficiency control program is justified and 2. determining appropriate intervention strategies.

A two-step assessment is proposed. The first step is a qualitative assessment. Approximately one week is needed to collect secondary data about vitamin A deficiency, associated risk factors, and anecdotal evidence of xerophthalmia from expert groups and local health centers. In-depth interviews and focus groups should be conducted to collect information about local nutritional and agricultural practices and the existence of a local term for night blindness.

The second step utilizes a semi-quantitative, population-based dietary questionnaire to assess average weekly frequency of consumption of locally available vitamin A rich foods among pre-school children. Analysis of both mean weekly consumption and bi-modal consumption (i.e., consumption of no vitamin A rich foods in the previous week or consumption of vitamin A rich foods at least every day) may reveal important information regarding the likelihood of a vitamin A deficiency problem in the surveyed area.

Such surveys have been successfully implemented for problem assessment and program planning purposes by private voluntary organizations in Haiti, Mali, and the Philippines (World Vision Relief and Development Agency in Haiti; Save the Children Federation/USA in Mali, Helen Keller International in the Philippines).

While such survey methods cannot substitute for a valid epidemiologic assessment<sup>1</sup>, they allow agencies to identify if VAD is likely to be a problem, the nature of the problem (production? consumption? both?) and can also guide development of appropriate intervention strategies. The alternative - waiting for an epidemiologic assessment - is an option that may have disastrous consequences for the local population.

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<sup>1</sup> Pending validation of a semi-quantitative food frequency methodology

BENEFICIAL EFFECTS OF VITAMIN A SUPPLEMENTS IN UNDERNOURISHED PREGNANT WOMEN. B. Sivakumar, National Institute of Nutrition Jamal-Osmania P.O., Hyderabad, INDIA-500 007.

About 450 pregnant women from low income group were recruited to study the effects of vitamin A supplementation on plasma vitamin A levels in mother and cord and on the fetoplacental function as reflected by plasma steroid levels and birth weights of the neonates. Results showed that supplementation with 1800  $\mu$ g vitamin A per day for more than 12 weeks prevented the decline in plasma vitamin A that otherwise occurred during the last few weeks of pregnancy. The improvement in maternal vitamin A status was accompanied by an elevation in cord vitamin A levels and thus fetal availability. Supplementation for a period 12 weeks and not less, was found to be essential, since subsequent discontinuation did not alter the beneficial response. Based on the distinct changes in plasma vitamin A during gestation in women with low initial vitamin A levels ( $\leq 30$  ug/dl) and their response to administered vitamin A, in conjunction with estimated daily intakes of vitamin A, the requirement was computed to be 780 RE/day. Vitamin A supplements also prevented the significant decline in hemoglobin occurring at 26-28 weeks of gestation. The mean increment in plasma progesterone, but not that in estradiol, during pregnancy was significantly higher in supplemented women as compared to controls. The beneficial effect of vitamin A on fetoplacental function, however, was not pronounced enough to be reflected in the birth weights. The functional significance of these vitamin A mediated benefits needs to be further investigated.

## VITAMIN A IN THE COMMUNITY: A PVO PERSPECTIVE

Anne L. Ralte, Director, Vitamin A Programs, Helen Keller International, New York

Helen Keller International (HKI) has been active in vitamin A program interventions since the early 1970's. In order to sustain program activities, HKI has traditionally worked in collaboration with local governments and organizations. Through a program specially targeted to provide technical support to the PVO community, HKI has been sharing its experience in vitamin A programming and assisting PVOs integrate vitamin A activities into ongoing child survival programs. HKI's Vitamin A Technical Assistance Program (VITAP) has provided its consulting and advisory services in more than 14 countries, trained over 23 PVOs in vitamin A programming issues and provided supporting training materials. VITAP has helped to strengthen PVO efforts and in-house capabilities in vitamin A programming resulting in vitamin A activities being initiated. Perspectives gained: (a) The PVO community, with its enormous outreach in community-based child survival activities, is an excellent channel for vitamin A interventions; (b) Increased funding from donors have helped PVOs initiate projects; (c) Among possible intervention strategies, PVOs are more likely to be interested in nutrition education, this is the easiest to integrate; (d) the greatest technical support need has been in training of program and field staff in vitamin A issues particularly in assessment; (e) the vitamin A newsletter is the most frequently requested item, demonstrating an interest in information exchange and sharing of experiences. In the 1990's, the PVO community, working in child survival, is expected to make an important contribution in the control and prevention of vitamin A deficiency. This is timely as new evidence confirms the link between vitamin A status and child health and survival.

**CRITICAL ELEMENTS IN SUCCESSFUL COMMUNITY-BASED VITAMIN A PROGRAMMING.** Wesley Vargas, World Vision Mauritania; Kabir Ahmed, World Vision Bangladesh; Florence Dyer, World Vision Haiti; Milton Amayun, World Vision Relief & Development, Inc. (WVRD), and Fe D. Garcia, WVRD.

This paper examines some lessons learned in Vitamin A programming from three Vitamin A projects in Asia, Africa, and Haiti. The common goal of these projects is to reduce Vitamin A deficiency among children through short-term Vitamin A capsule distribution and long-term increase in dietary consumption of Vitamin A-rich foods. The project sites include an urban slum of Dhaka, Bangladesh, the desert region of Assaba, Mauritania, and the rural island of La Gonave in Haiti. The aggregate population is 311,291.

In Assaba, desert gardening has become a yearly event for many traditional nomadic villages. In Dhaka, VAC coverage of target groups has been more than 90 percent for the last two years. On La Gonave Island, predominantly male Traditional Birth Attendants are actively involved in VAC distribution to mothers who recently delivered.

Three years of experience in implementing the above projects indicate the following critical elements that need to be addressed: availability of land and land tenure, presence of water, community involvement, staff competence and commitment, integration of Vitamin A with Child Survival activities, awareness of factors influencing food consumption patterns and agricultural practices, trained cadre of local health workers, existence of government policy in nutrition, and sustainability strategies. While Vitamin A capsule distribution is easy to implement in most Third World settings, the long-term behavior change is difficult to measure and will need more investigation. The resolution of problems related to it involved sociocultural and political interventions.

INTERNATIONAL EYE FOUNDATION  
CHILD SURVIVAL AND VITAMIN A PROJECTS REPORT.

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The International Eye Foundation is committed to the prevention and cure of blindness worldwide. As xerophthalmia due to vitamin A deficiency is the leading cause of childhood blindness in developing countries, the IEF has been involved in community-based programs to reduce vitamin A deficiency in Africa and Latin America. The IEF is currently working in Malawi, Guatemala and Honduras with a variety of community-based projects that include high dose vitamin A capsule distribution, nutrition education, promotion of gardening, and applied research. The IEF also supports vitamin A-related host country programs such as the Expanded Program for Immunization and the Control of Diarrheal Disease program. Vitamin A is viewed as a part of the larger host-country child survival programming and serves to strengthen existing primary health care delivery systems of these nations.

THE FAO SUB-REGIONAL COMMUNICATION SUPPORT PROJECT FOR PREVENTION OF VITAMIN A DEFICIENCY IN THE SAHEL. Dr. Franz Simmersbach, Nutrition Officer, Food and Agriculture Organization, Via delle Terme di Caracalla, Rome 00100, Italy.

1. In order to achieve the goals of the UN Ten-Year Action Plan for Control of Vitamin A Deficiency, Xerophthalmia and Nutritional Blindness short-term, mid-term and long-term measures should be employed concomitantly. FAO has the mandate to support and implement the long-term measures and currently has on-going projects in Vietnam, Burkina Faso, Malawi, Mali, Chad and Nepal to help rural communities strengthen their home production of appropriate vegetables and fruits, assist in the training of field staff to strengthen technical services to the communities and educate the public to improve their dietary habits.
2. The ultimate solution for controlling or even eliminating this preventable deficiency lies in measures which have a long-term solution. Those measures are indisputably food-based: the increased production of vitamin A and carotene rich foods; appropriate enriched foods and the ensured access of such foods; promotion of the adequate consumption of those foods by population groups in need of them; and means to control and assure that foods contain appropriate levels of vitamin A and other micronutrients as well.
3. Both increased production and access are essential preconditions for increasing consumption of vitamin A rich food, but are themselves not a sufficient guarantee per se for the prevention of vitamin A deficiency. What is needed is a dietary behaviour and habit that ensures that these foods are also consumed. Effective nutrition education is essential to bring about or reinforce desirable dietary habits needed towards the long-term solution of vitamin A deficiency. It is for this reason, in addition to promoting the food production aspects, in FAO vitamin A assistance projects that nutrition education has been a priority.
5. Therefore FAO is providing assistance to support the on-going FAO vitamin A projects in the Sahel with a special programme on nutrition education through the use of mass media in five Sahelian countries (Burkina Faso, Chad, Mali, Mauritania and Niger). The project will be funded by the FAO Technical Cooperation Programme with some US\$ 380,000 and is expected to start by October 1991.
6. The first purpose of the project is to provide training to relevant government staff (nutritionists, radio/television people, communication experts, national vitamin A programme staff) in how to use mass media in nutrition education, develop and test messages and materials and diffuse it to a defined target audience. This training will stress the need for collaboration between the different sectors - education, health, nutrition, agriculture, communication and the people.
7. The second purpose is to provide technical expertise to governments to assist in developing national follow-up programmes on nutrition education for the public with special emphasis on prevention of vitamin A deficiency. In this process it is also aimed to establish national focal points for communication for nutrition education which will allow coordination of various efforts made in this field by government agencies as well as those supported by donor groups.
8. The technical institutions to be involved in this project will be the Service Center for Audiovisual Production (CESPA) in Bamako, Mali; the Inter-african Study Center on Rural Radio (CIERRO) in Ouagadougou, Burkina Faso. The Institute of the Sahel in Bamako, Mali will have the coordinating role for this project. International NGOs, AED and HKI, both supported by USAID, as well as UNICEF have agreed to collaborate with FAO on this project.
9. The outcome of this sub-regional project is expected to be: i) a strengthened technical national cadre in communication able to effectually contribute to on-going vitamin A programmes; ii) established national fora for coordination of nutrition communication programmes; iii) formulated national follow-up programmes; iv) technical cooperation among the participating countries.
10. It is the conviction of FAO that long-term solutions to vitamin A and other micronutrient deficiency problems are feasible. Nutrition education of the public, the adults, youth and the school children, is an essential activity to overcome these problems.

VITAMIN A NUTRITION PROGRAM; Frances R. Davidson, United States Agency for International Development, Washington, D.C.

The U.S. Agency for International Development has had a continuous vitamin A program in place since 1976. Activities are carried out in A.I.D. supported countries in collaboration with in-country counterparts, other donor or international organizations and non-governmental organizations such as private voluntary organizations both U.S. based and indigenous. This program has and continues to support:

1. APPLIED RESEARCH: to increase the scientific basis for understanding the relationship between vitamin A deficiency and childhood morbidity and mortality; refine assessment techniques, especially field appropriate ones; and test out and evaluate innovative interventions for sustainable control of vitamin A deficiency.
2. TECHNICAL ASSISTANCE AND TRAINING: to determine the location and extent of vitamin A deficient populations at the national and sub-national level; assist in development of institutional capacity for sustainable programs for the control and elimination of vitamin A deficiency; and determine appropriate intervention strategies, evaluate effectiveness and document lessons learned. Training is undertaken to develop a cadre of qualified individuals in host countries to ensure sustainability of programs.
3. INFORMATION COLLECTION AND DISSEMINATION: through support of consultative groups such as IVACG for development and publication of state of the art documents on vitamin A; support of international meetings; publication and dissemination of reports on experiences of program implementation, e.g., compilation of home and community gardening experiences of diverse organizations; and newsletters, e.g., Xerophthalmia Bulletin, VITAL News.

To reach the goal of elimination of vitamin A deficiency, USAID supports integration of vitamin A delivery systems with other child survival activities; targeting interventions to areas, communities, age groups and seasons of highest risk; selection of a set of complementary interventions to enhance sustainability and impact based on conditions unique in each program situation rather than dependence on a single intervention; engaging agriculture, food processing and other relevant sectors in ensuring adequate vitamin A in food supplies and access to food by poorer segments of the population; and continued research in support of program and policy decisions.

**ACCELERATING DELIVERY OF VITAMIN A SUPPLEMENTS BY USING IMMUNIZATION PROGRAMMES, Nicholas Cohen MD, Expanded Programme on Immunization, World Health Organization, Geneva, Switzerland.**

The 1990 Global Advisory Group meeting of the Expanded Programme on Immunization (EPI) drew attention to the 500 million contacts with infants and women of childbearing age each year occurring through immunization services. It recommended that all countries where there are serious vitamin A deficiency problems should consider taking advantage of these contacts to deliver vitamin A supplements. Countries which have linked already vitamin A supplementation to immunization programmes and/or national immunization days include Bangladesh, Brazil, Haiti, India, El Salvador, Guatemala, Malawi, Mali, Mauritania and Nepal.

The EPI recommendation is for oral vitamin A supplementation, 100,000 IU, to infants from the age of 6 months. Children over the age of one year should be given 200,000 IU vitamin A supplement. A joint WHO/UNICEF consultation group considered, in December 1990, there was inadequate evidence to recommend supplementation of children as early as 6, 10 and 14 weeks of life along with DPT and oral polio vaccine administration. Clinical trials of safety of vitamin A supplements in early life, as well as analysis of impact, are in progress. Meanwhile, there is support for giving 200,000 IU vitamin A supplement to mothers within four weeks after delivery, with the aim of raising vitamin A levels in breast milk.

A combination of coverage and disease outcome surveillance (night blindness where there is a local term and corneal scars) could be used to measure progress towards elimination of vitamin A deficiency. A model has been developed for estimating incremental costs of adding vitamin A supplementation to immunization programmes. If 20% of mothers were reached with vitamin A supplements by immunization programmes and 80% of children after the age of 6 months, the cost per mother and child reached is estimated at US\$ 0.46.

Increased demand for vitamin A can be expected as programmes accelerate. Supply forecasts up to 1997 have been made using different scenarios.

**SQUAMOUS METAPLASIA IN THE RESPIRATORY EPITHELIUM OF CHILDREN WHO DIED OF PNEUMONIA.** N.C. Gonzaga, V.M. Anderson, E.E. Navarro, and S.C. Quiapo, T.E. Tupasi. (Tropical Disease Foundation, Makati Medical Center, Manila, Philippines; New York City Department of Health, New York, U.S.A.; and Research Institute for Tropical Medicine, Department of Health, Manila, Philippines).

Morphologic changes of the respiratory epithelium of 71 malnourished children who died of pneumonia are described. Squamous metaplasia of the respiratory epithelium was noted in 62 (87%) of 71 patients. The lesion was confined at the level of the trachea in 22 (46%) and extensively involved in the bronchi in 40 (42.3%). It affected not only the lining epithelium of the mucosa but also the submucosal glands where the changes simulate that of the morphology of cystic fibrosis of the pancreas. Measles and malnutrition based on anthropometry and fatty change of the liver, appeared to be important risk factors for this cellular adaptive mechanism. All children who were classified as stunted, 87.5% among wasted and 86.4% in both stunted and wasted were affected. The pathologic findings provide the morphologic basis for the possible association of vitamin A deficiency with increased ARI morbidity and mortality from developing countries and underscore the importance of proper nutrition and vitamin A supplementation as strategies for ARI control.

**AN APPROACH TO COMMUNITY BASED RESEARCH. Dr. (Mrs.) Laxmi Rahmathullah, M.B.B.S., D.T.P.H., Aravind Children's Hospital, Madurai 625 020, India; Ravilla D. Thulasiraj, M.B.A., Aravind Eye Hospital, Madurai 625 020, India; Barbara A. Underwood, Ph.D., National Eye Institute, National Institutes of Health, Bethesda, MD 20892, USA.**

Those establishing a community-based development program often face a dilemma: although the necessary theoretical knowledge and technology are usually available, there is the problem of how to transfer these into a program that considers factors such as cultural variations, logistical constraints, economic potential, political stability, and literacy levels. Unique models appropriate for the given situation are needed. But this necessitates obtaining reliable information from the community. Because people usually talk most honestly with their friends and neighbors, workers from within the community consistently provide the most reliable information. Nevertheless, because those workers frequently have very little education, they are sometimes considered by those in the scientific and professional community to be unable to provide high quality information.

Field Programs--as opposed to hospital-based clinical trials or laboratory-based studies--require strong management systems because they are conducted in less controlled environments, yet they must be designed with sensitivity to the community's culture, religious beliefs, and social practices. In addition, these trials usually involve large numbers of people, which necessitates complex logistics, and they often use field staff who are less educated and require special training and frequent monitoring. Because mistakes are expensive in field studies and errors in data-collection are difficult to rectify, monitoring must be continuous. Unless errors are identified and resolved as they arise, these problems can interfere with the continuation of the study.

Recently a large field based research project was conducted utilizing 294 persons from the community by Aravind Children's Hospital in Madurai, Tamil Nadu. The work required weekly contact with 15,419 children to deliver a supplement and obtain information on their daily illness patterns for 1 year. The children were located in scattered rural communities many of which were of low population density. Because the environment was dry and hot and the communities lacked easy access, the working conditions were difficult. Such a field research project could not have been undertaken without local co-operation and support.

The benefit offered to the community were jobs in the project. This was a felt need and a requirement for community involvement. A good management system was in place and the project was completed with 12 full time qualified workers and 7 part time workers and the rest of the 294 workers were from the community. To ensure quality of data, training was given on codes at meetings held every week. This project not only obtained community participation but it also left behind a well trained cadre of community health volunteers in the community who have been sensitized to health issues.

This project had full co-operation from the people, bureaucracy and health department. The success of the project is based on the fact that 88 to 90% of the children in the study were contacted every week for 1 year.

**HOW "LONG TERM" INTERVENTION IS NUTRITION EDUCATION: CHARACTERISTICS AND DETERMINANTS OF PROGRAM COVERAGE IN RURAL NEPAL.** Chet Raj Pant, Filippo Curtale, Robert Tilden, G.P. Pokharel, Su Jean Pak, Jonathan Gorstein, Jon Fryzek, Ya Ching and the VACSP Team. c/o NNJS PO Box 335 Kathmandu Nepal, Vitamin A Child Survival Project.

Nutrition Education is often cited as being the "long-term" intervention, as opposed to the capsule distribution program, which is considered "short-term". The Nepal Vitamin A Child Survival Project shows comparable reductions in Bitot's spots rates between the "long-term" intervention and the "short-term" intervention in less than one year. This despite initial literacy rates of 6.3%.

Level of participation within the four different community based vitamin A deficiency programs were varied. Household, material, and community attributes of participation are reviewed. Other non direct factors and their impact on improving performance of the different programs are considered. Maternal literacy is a major factor in predicting not only participation in the interventions, but also in the reduction of risk of xerophthalmia. The time and mechanisms to improve literacy rates in areas with high rates of non-literate mothers is shown, and its effect on participation is illustrated.

INTAKE OF DIETARY VITAMIN A BY RURAL AND URBAN GUATEMALAN PRESCHOOL CHILDREN: PATTERNS OF CONSUMPTION OF RETINOL AND PROVITAMIN A SOURCES. J. Quan de Serrano and L. de Gonzalez. Center for Studies of Sensory Impairment, Aging and Metabolism Guatemala, Guatemala, C.A.

Guatemala is a country with a history of hypovitaminosis A. The population more dramatically affected are those below 15 years. Among Guatemalan preschoolers examined in the Central American Nutrition Survey of 1965-67, about 17.8% of a total of 1219 subjects examined with less than 15 years, had circulating retinol levels below 20 ug/dl. Dietary data from the same survey suggested that 43% of the 307 families studied had per capita intakes of vitamin A of less than 400 RE during the previous 24 hours prior to the interview. To assess the contemporary vitamin A intake and patterns of consumption of retinol and provitamin A sources of preschoolers from diverse regions of Guatemala, a seven-day food-frequency questionnaire (7-FFQ) was utilized. The mothers or caretakers of 296 preschoolers and 19 school-age children were interviewed. Data were collected and analyzed by experienced nutritionists, and converted into estimates of vitamin A intake using the Latin American Food Composition Tables. The median estimated amount of dietary vitamin A consumed by the rural and peri-urban preschoolers was 301 RE/day, with 50.5% of these children having an intake below that recommended by FAO/WHO. The fraction of dietary vitamin A activity from provitamin A ranged from 26.0% to 85.5% depending on the community studied, but averaged 60.5%. The following table contains information about vitamin A consumption regarding items as principal dietary sources and frequency of consumption:

| ORDER | LEADING DIETARY SOURCE | PREDOMINANT VIT. A ACTIVITY | FREQUENCY OF CONSUMPTION | PREDOMINANT VIT. A ACTIVITY |
|-------|------------------------|-----------------------------|--------------------------|-----------------------------|
| 1 st  | Ripe mango             | provitamin                  | Chicken egg              | preformed                   |
| 2 nd  | Incaparina             | preformed                   | Ripe tomato              | provitamin                  |
| 3 rd  | Beef liver             | preformed                   | Ripe mango               | provitamin                  |
| 4 th  | Carrot                 | provitamin                  | Fresh cheese             | preformed                   |
| 5 th  | Chipilin               | provitamin                  | Macuy                    | provitamin                  |
| 6 th  | Macuy                  | provitamin                  | Cantaloupe               | provitamin                  |
| 7 th  | Chicken egg            | preformed                   | Ripe plantain            | provitamin                  |
| 8 th  | Powdered milk          | preformed                   | Watercress               | provitamin                  |
| 9 th  | Fluid milk             | preformed                   | Carrot                   | provitamin                  |
| 10 th | Cantaloupe             | provitamin                  | Incaparina               | preformed                   |

CONJUNCTIVAL IMPRESSION CYTOLOGY: FIELD EXPERIENCE AND PRELIMINARY RESULTS IN A  
LARGE-SCALE VITAMIN A SUPPLEMENTATION TRIAL IN GHANA.

David A Ross, Fred N Binka, Paul Arthur, J. Kwabena Badu, Conrad Weobong, Nicola Dollimore, Saul Morris, Ghana Vitamin A Supplementation Trial (VAST), PO Box 114, Navrongo, Ghana.

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Hutton A Addy, School of Medical Sciences, University of Science and Technology, Kumasi, Ghana.

Andrew Tomkins, Institute of Child Health, 30 Guilford St, London WC1N 1EH, UK.

Two laboratory workers attempted to take conjunctival impressions from both eyes of 1835 children aged less than six years, as part of the baseline surveys for the Ghana Vitamin A Supplementation Trial which is being conducted in a rural area of the Upper East Region of Ghana. The technique used was based on the one in the ICEPO training manual, with only minor modifications. A total of 2468 impressions were collected for analysis, with at least one impression from 1395 children (76.0%). All these samples were processed and are being independently examined by the two laboratory technicians in a small field laboratory at the study site. A subsample are also being examined by two more experienced investigators in London and Baltimore. Blood samples were also taken from the same children for haemoglobin, serum retinol, albumen, retinol binding protein, ferritin and zinc estimation. Both the results of the conjunctival impressions and their interrelations with the blood results will be presented, along with the results of the quality control procedures. The feasibility of using conjunctival impression cytology as a routine field method for estimating the vitamin A status of populations will be discussed.

EFFECT OF A SINGLE ORAL DOSE OF VITAMIN A (200,000 IU) ON DIARRHEAL AND RESPIRATORY MORBIDITY AMONG PRESCHOOLERS OF RURAL GUATEMALA. Bartlett, A., Cruz, J.R., Kjolhede C., and Sibrián, R., Institute of Nutrition of Central America and Panama, Guatemala City, and The Johns Hopkins University, Baltimore, Maryland, USA.

A surveillance program aimed at determining the epidemiology of persistent diarrhea was carried out in Santa María de Jesús, a rural community in the highlands of Guatemala, from February 1987 to October 1989. Twice a week, field personnel visited the homes of 150-200 families with children 0-35 months of age to obtain information on morbidity (including diarrhea, cough, fever, signs and symptoms of acute lower respiratory infections). Additionally, weight and height of every child was monitored routinely.

On October 16, 1988, the National Vitamin A Campaign offered children aged 6 months or older a single oral dose of 200,000 IU of vitamin A. Families brought their children to specific posts on a voluntary basis (see accompanying abstract). Approximately 62% of children participating in our program received vitamin A.

Due to the characteristics of the surveillance system, it was possible to explore the effect of the intake of 200,000 IU of vitamin A on diarrheal and acute respiratory morbidity. The age, nutritional status and previous morbidity were not comparable between the children who took vitamin A and those who did not. Therefore, we compared morbidity rates of children receiving vitamin A with those who did not and with the complete morbidity data of the 0-35 month old child population prior to the vitamin A campaign, taking into account the effect of these other variables. The results of these comparisons will be presented and discussed.

**IMPACT OF VITAMIN A SUPPLEMENTATION ON DIARRHOEA AND ACUTE RESPIRATORY INFECTION IN CHILDREN.** Maurício Lima Barreto, Leonor Pacheco Santos, Ana Marlúcia O. Assis, Gilmor J. Farenzena and Maria de Purificação N. Araujo. Departamento de Medicina Preventiva and Departamento de Ciências da Nutrição, Universidade Federal da Bahia, Rua Araujo Pinho 3: 40140, Salvador, Bahia, Brasil.

This study aims at evaluating the impact of vitamin A supplementation on the incidence, duration and severity of diarrhoea and of acute respiratory infection (ARI) in children aged 6 to 48 months, from the semi-arid region of the state of Bahia, Northeast Brasil. The study site is the town of Serrinha, 170 km from Salvador, the state capital. The study is double blind and the vitamin A is administered in capsules every four months. The dose is 200,000 IU for children older than one year and 100,000 IU for the ones 6 to 12 months. The sample size is of 1,200 children, 600 in each group. The data collection is made by 20 trained field workers, hired in the community; each child is visited every day and data on diarrhoea (number of dejections/24 hs, consistency, presence of blood) and on acute respiratory infection (respiratory frequency) are collected. Children with respiratory frequency greater than 45/min are examined by the pediatrician for the diagnosis of ARI. The study period started in December of 1990 and is planned for 12 months. However, at the sixth month, a preliminary analysis will be performed by an independent investigator and, according to the results, the study will be or not continued.

## EFFECT OF VITAMIN A DEPLETION AND REPLETION ON SECONDARY IMMUNE RESPONSE TO PROTEIN ANTIGEN; TETANUS TOXOID (TT)

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We have previously reported that vitamin A-depleted rats were impaired to generate primary (1°) immune response to TT. This time we assessed the effects of vitamin A depletion and repletion on the secondary (2°) response to TT. 51 male Lewis rats were raised on either vitamin A-free or adequate diets and were immunized at 40 and 60 days of age with 100 µg of TT. Vitamin A levels of serum and liver assayed by HPLC were low in vitamin A-deficient rats, while those of controls and vitamin A-depleted rats that were repleted 1.5 mg of retinol either 1 day after the 1° immunization (R1) or 2 days before the 2° immunization (R2) were equal. Peak titers of IgM and IgG anti-TT in the 1° and 2° response, assayed by ELISA, were as follows;

|              | 1° IgM a-TT  | 1° IgG a-TT  | 2° IgM a-TT  | 2° IgG a-TT   |
|--------------|--------------|--------------|--------------|---------------|
| VA-deficient | 1.76 ± 1.26  | 1.95 ± 1.38  | 9.33 ± 1.12  | 45.71 ± 1.41  |
| R1           | 10.38 ± 1.34 | 12.88 ± 1.23 | 23.99 ± 1.23 | 338.84 ± 1.26 |
| R2           |              |              | 19.95 ± 1.35 | 104.71 ± 1.12 |
| Control      | 8.63 ± 1.19  | 5.01 ± 1.29  | 19.50 ± 1.12 | 190.55 ± 1.55 |

Vitamin A-deficient rats produced low titers of anti-TT in both the 1° and 2° responses, although the 2° IgG response was 69 times higher than the 1° response, which was not from that of control. Vitamin A-repleted rats, R1, had the 1° and 2° Ab responses at least as great as those of controls. The 2° response of R2 were equal in magnitude to those of control. Those differences of immune responses were not due to the differences in kinetics of antibody production. This study shows that 1) antibody production in both 1° and 2° response to TT was highly dependent on the vitamin A status, 2) these low antibody production was normalized by vitamin A repletion even after the 1° immunization, and 3) the immunologic memory was still generated in the vitamin A-depleted animal.

VITAMIN A DEFICIENCY, INFECTION AND THE IMMUNE FUNCTION: STUDIES USING THE CHICKEN AS MODEL. C.E. West, S.R. Sijtsma, J.H.W.M. Rombout and A.J. van der Zijpp. Wageningen Agricultural University (The Netherlands).

**Background:** Increased prevalence and severity of infections such as measles result from decreased host resistance. Many infections begin with local invasion of an epithelial surface, the integrity of which and ability to regenerate after damage are compromised in vitamin A deficiency. Infections then spread to other tissues and this is facilitated by the circulatory system but hindered by non-specific antimicrobial substances and phagocytes especially during the first days of primary infection. However, recovery from a fully established infection is determined by immune responses appearing some days after initiation of infection.

**Methods:** In order to examine the mechanism of interaction between vitamin A deficiency and infections such as measles, a model was developed in which chickens were made deficient in vitamin A and infected with a virus somewhat similar to measles virus, Newcastle disease virus. Infection with this virus was shown to reduce serum vitamin A concentrations in marginally-deficient chickens to levels which could be regarded as deficient.

**Results:**

**Non-specific mechanisms of host resistance:** Many infections begin with local invasion of an epithelial surface, the integrity of which and ability to regenerate after damage are compromised in vitamin A deficiency. Subsequently, infections spread to other tissues and this is facilitated by the circulatory system but hindered by non-specific antimicrobial substances and phagocytes especially during the first days of primary infection. In our model, vitamin A deficiency has been shown to impair microbicidal activity and phagocytosis by peritoneal macrophages in both NDV-infected and non-infected chickens.

**Role of lymphoid organs and blood lymphocytes:** The immune system comprises a number of organs and cell types which have evolved to recognize non-self antigens on microbes and microbe-infected cells prior to their elimination. In our model we could demonstrate decreased weight of the bursa of Fabricius which is a measure of B cell production while reduction in the weight of thymus, a measure of T cell production, was seen only in vitamin A-deficient chickens infected with NDV. There was a marked lymphopaenia in vitamin-A deficient chickens which was even more pronounced during the acute phase of NDV infection.

**Systemic cell-mediated immunity:** Depressed cellular response to mitogens in vitamin A deficiency has been reported in rats and chickens. Our results and those of others indicate that vitamin A deficiency reduces cytotoxic T lymphocyte activity to NDV. This impairment in an important component of the cell-mediated defense system could be important for recovery from viral infection.

**Systemic humoral immunity:** Effects on humoral immunity are less consistent and pronounced although the production of T-cell dependent antigens has been shown to be inhibited in vitamin A deficiency.

**Mucosal immunity:** The basic component of immunological protection at mucosal surfaces is sIgA. In our model, vitamin A deficiency lowered the concentration of sIgA in bile and this effect was even more pronounced in chickens also infected with NDV. However, there was no effect on the IgM concentration in bile or on the number of IgA- or IgM-containing plasma cells in mucosal cells indicating that hepatobiliary transport of sIgA is impaired in vitamin A deficiency and that this effect is exacerbated by NDV infection. Thus the host's defence against both primary and secondary infections would be impaired.

**Conclusions:** In vitamin A deficiency, many aspects of non-specific and specific host defence mechanisms have been found to be affected in an animal model.

ENHANCED T-LYMPHOCYTE BLASTOGENIC RESPONSE TO TUBERCULIN (PPD) IN CHILDREN OF NORTHEAST (NE) THAILAND SUPPLEMENTED WITH VITAMIN A (VA) AND ZINC (Zn). TR Kramer, E Udomkesmalee, S Dhanamitta, S Sirisinha, S Charoenkiatkul, S Tantipopipat, O Banjong, N Rajroongwasinkul & JC Smith, Jr. USDA, Vitamin & Mineral Nutrition Laboratory, Beltsville, MD 20705 & Institute of Nutrition, Mahidol University at Salaya, Nakhon Pathom 73170 Thailand.

Beneficial effects of VA and/or Zn supplementation of children in NE Thailand are described in a companion abstract (Udomkesmalee et al.). In the same study, blastogenic response (BR) of T-lymphocytes to concanavalin-A (ConA) and PPD were assayed in cultures containing mononuclear cells (MNC) or whole blood (WB). Methods were previously described (Ann NY Acad Sci 587:300-2, 1990). Children were previously vaccinated with BCG. Results: BR to ConA of MNC or WB from children supplemented with VA, Zn, VA + Zn or placebo were similar. BR to PPD of MNC was significantly higher in children receiving VA + Zn than placebo, but not in children supplemented with VA or Zn alone. Summary: Data indicate that children with suboptimal VA and Zn nutriture supplemented with < 2 times RDA of these nutrients showed enhanced cellular immunity to PPD. This observation is relevant to BCG immunization program and thus, may benefit public health. Funded in part by the U.S. Agency for International Development, The Royal Thai Government & the U.S. Department of Agriculture.

**VITAMIN A STATUS OF CHILDREN IN BELIZE, CENTRAL AMERICA.**

**D. Makdani, A. Hegar, E. Gunter, A. Sowell and J. C. Smith, Jr.** Lincoln University, Jefferson City, MO 65102, Belize Govt Hosp, Belize City, Ctrs Disease Control, Atlanta, GA 30333, and Vitamin and Mineral Nutrition Laboratory, USDA, Beltsville, MD 20705.

Earlier studies based on nutritional surveys have indicated inadequate intakes of vitamin A (VA) by a large percentage of children in Belize. The present study involving 508, 2-8 y children from 6 ethnic groups, was undertaken to assess VA status as measured by relative dose response (RDR) technique, serum vitamin A and retinol binding protein (RBP). Approximately 60% of the children showed inadequate VA liver stores (RDR > 20%). Among different ethnic groups, Garifuna and Kekchi Indian children (in southern Belize) exhibited the largest percentage (67% and 86%) with inadequate VA stores. Age or gender was not a variable related to VA status except for the 2 y age group. A high correlation was evident for VA/RBP,  $r=0.79$   $p<0.01$ , confirming numerous previous reports. In view of high percentage of children with inadequate VA liver stores, efforts to increase VA intake would be warranted. (Supported by U.S. Agency for International Development - HBCU).

THE RELATIONSHIPS BETWEEN VITAMIN A STATUS AND OTHER NUTRITIONAL AND HEALTH RELATED FACTORS IN YOUNG CHILDREN IN THE UPPER EAST REGION OF GHANA: A CROSS-SECTIONAL STUDY

Nicola Dollimore, Saul Morris, David A Ross, Paul Arthur, Fred Binka (Ghana Vitamin A Supplementation Trial (VAST), PO Box 114, Navrongo, Ghana); Betty Kirkwood, Peter G Smith (London School of Hygiene and Tropical Medicine, Keppel St, London WC1E 7HT, UK); Hutton A Addy (School of Medical Sciences, University of Science and Technology, Kumasi, Ghana), Andrew Tomkins (Institute of Child Health, 30 Guilford St, London WC1N 1EH, UK).

Over 16,000 young children in a rural area of Northern Ghana were visited and examined as part of the baseline surveys for the Ghana Vitamin A Supplementation Trials (the Child Survival and the Child Health Study). The vitamin A status of these children is being assessed through questions on night blindness, conjunctival impressions and serum analysis. A wide range of additional information was also collected at baseline including information on the recent illnesses, anthropometric status and vaccination histories of children; their mother's fertility history and breast feeding status and parental educational levels. Socio-economic indices and ownership and storage of selected basic vitamin A rich foods was assessed at the compound level. Detailed information was also collected for some children (those in the child health study) on the environmental conditions in which they lived (eg sources and storage of water, cooking facilities, etc); use and knowledge of ORS by their mothers and partial dietary histories.

The relationships between vitamin A status and these nutritional and other health related factors will be presented, highlighting the important associations.

## VITAMIN A DEFICIENCY IN ETHIOPIA

Zewdie Wolde Gebriel, Ethiopian Nutrition Institute, Addis Ababa, Ethiopia and C.E. West, Wageningen Agricultural University (The Netherlands).

A series of studies has been carried out to determine the extent of vitamin A deficiency and xerophthalmia in Ethiopia.

1. National survey on xerophthalmia:

A total of 6636 children, aged from 6 mo to 6 yr and selected throughout the country using a multistaged stratified sample design, were examined for signs of xerophthalmia. The concentration of retinol and of  $\beta$ -carotene was measured in 791 children selected at random. Bitot's spots were seen in 1.0% of all children which is above the level of 0.5% which is regarded as indicating that vitamin A deficiency is a problem of public health significance. The prevalence of Bitot's spots was higher in the pastoral (1.7%) and cropping (1.1%) agro-ecological zones than in the cash crop (0.4%) and "ensete" (0.0%) zones. One case of corneal xerosis and 2 cases of corneal scar were also seen. Serum retinol levels were deficient ( $< 10 \mu\text{g}/100 \text{ ml}$ ) in 1.8% of cases and low ( $10 - 19 \mu\text{g}/100 \text{ ml}$ ) in 4.8% of children selected randomly.

2. Causes of blindness in children in the blind schools of Ethiopia:

A total of 721 children in the six schools for the blind in Ethiopia were studied in the period from July 1988 until February 1989. Histories were taken to ascertain the predisposing factors and ophthalmological examinations or records were used to determine the causes of blindness. Ninety-five per cent of those examined had bilateral blindness, 12% did not know how they had become blind and, of those who provided information on how they became blind, 21% knew that they were born blind, 30% implicated measles as being responsible, and 13% implicated "mitch" which is an Amharic term used to describe a very wide range of non-specific and vague illnesses of which measles probably constitutes a significant proportion. Seventy per cent of the blindness was due to corneal opacity or phthisis bulbi. Of those with non-congenital bilateral corneal opacity or phthisis bulbi, 40% were preceded by measles and 17% by mitch. A study of 66 adults in the handicraft and skill-training centres attached to the blind schools was also carried out. The principal predisposing factors were mitch (30%), small-pox (15%), cataract (12%), and traditional eye medicine (11%). On examining the eyes of the adults 70% had corneal scars or phthisis bulbi and 14% had cataract.

3. Hyperprevalence of hypovitaminosis A in Harerge Region:

As a result of a report of serious eye problems in a village 400 km by road east of Addis Ababa in Harerge Region, a study was carried out by the staff of the Ethiopian Nutrition Institute in September 1988. All 240 children under the age of 13 yr were examined and 95 were found to have night blindness, 18 had unilateral or bilateral Bitot's spots, and 15 had unilateral or bilateral corneal ulcers. In the previous 2 yr, 70 children had died of whom 17 were reported to have had symptoms which suggested keratomalacia.

STUDY ON VITAMIN A DEFICIENCY IN ETHIOPIA, A COUNTRY AFFECTED BY RECURRENT DROUGHT AND FAMINE. Marina Repola,<sup>(1)</sup> Via dei Cipressi 9b, 37033 Montorio, Verona, Italy.

The study was conducted in 1989. Its objectives were to clarify the extent of vitamin A deficiency (vAd) in Ethiopia and its geographical distribution, to identify the areas at risk and to detect, amongst various possible causes, those primarily responsible for vAd. The study consisted of collection, analysis and comparing existing and new data from institutions dealing with eye problems and blindness, child health and nutrition: all the eye clinics, the six schools for the blind, pediatric out patients departments and wards, mother and child health clinics and kindergartens were visited. 623 children were examined by a local ophthalmologist. These data were integrated with other information and observations on people's knowledge of vAd, nutritional habits and availability of food. Particular attention was given to areas recently affected by drought and famine. We would conclude that vAd is a serious problem for many Ethiopian children. Its geographical distribution does not appear homogeneous. The main factors which contribute to vAd are ecology and use of land, nutritional habits, epidemics (particularly measles), seasonality and drought. They play their role alone or in different combinations reaching dramatic effects (Arsi Region) and not only on the under six year old population. VAd can be solved only via an integrated preventive action in which different competent agencies (Min. of Health, Min. of Education, Min. of Agriculture) can offer their collaboration. The priority actions are to: strengthen action to immunize children against measles, implement nutritional education, improve knowledge of health personnel and give particular attention to people facing nutritional emergencies.

(1) The author has conducted the study as a consultant for WHO Panafrican Centre for Emergency Preparedness and Response, Addis Ababa, Ethiopia.

VITAMIN A DEFICIENCY IN KIRIBATI. Donna Nager, The Foundation for the Peoples of the South Pacific (FSP), San Diego, California; Robert Gern, Helen Keller International (HKI); Dr. T. Taitai, Kiribati Ministry of Health (MOH); Patricia Monahan, FSP; Dr. Janet O'Connor, MOH; Dr. Guy Hawley, FSP; Dr. Nancy Sloan, HKI/VITAP.

A survey was conducted in Kiribati from 11 September to 9 October 1989 to determine whether vitamin A deficiency posed a public health problem. Six islands were selected, half in the north and half in the south of the country. A total of 4,614 children aged six months through five years in 64 villages were examined for eye signs and symptoms of xerophthalmia. Health status was assessed for the total sample. Mid-upper arm circumference, socioeconomic status and dietary intake of vitamin A-rich foods were assessed on a subsample of children.

The survey found rates of xerophthalmia in Kiribati to be nearly ten times greater than the World Health Organization criteria for a public health problem, 14.7% of children under six years had one or more active clinical signs or symptoms of xerophthalmia. These results are among the first to be documented in the South Pacific and are similar to recent findings in Truk.<sup>1</sup>

Vitamin A consumption and mid-upper arm circumference were the sole risk factors associated with active xerophthalmia. Measles was the only risk factor associated with corneal scarring.

The key recommendations were to: 1) develop a national policy to make the prevention and control of vitamin A deficiency a priority for promoting child health and survival, and controlling nutritional blindness; and 2) establish a program that would focus on nutrition education, increasing the consumption of vitamin A rich foods among pre-school aged children and pregnant women, and the prophylactic and therapeutic distribution of vitamin A capsules.

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<sup>1</sup> Lloyd-Puryear, M., Mahoney, J., Humphrey, JH, et al. (in preparation) Vitamin A Deficiency and Anemia and Stunted Growth in Truk: A statewide survey in Truk, Federated States of Micronesia.

**VITAMIN A STATUS IN URBAN SLUMS OF KARACHI.** A. Molla, S. Badruddin, M.K. Khurshid, A.M. Molla, F.N. Rahaman, S. Durrani, A. Suria, Z.I. Khan, J. Snyder and K. Hendrix. The Aga Khan University Medical Centre, P.O. Box 3500, Stadium Road, Karachi-74800, Pakistan and Applied Diarrhoeal Disease Research Project (ADDR), Harvard Institute for International Development, One Elliott Street, Cambridge, Massachusetts 02138.

A small scale baseline survey was conducted to estimate vitamin A status during Feb 89-March 90 in a random sample of 532 children selected from three urban slums of Karachi. Information on presence of clinical eye signs, anthropometry, history of night blindness, diarrhoea, respiratory tract infection and dietary intake data were obtained. Serum retinol level was estimated using the HPLC method for all the children. None of the children had clinical eye signs, however, deficient serum retinol level ( $<10 \mu\text{g/dl}$ ) was present in 2.3% of the total children. Low serum retinol level ( $10- <20 \mu\text{g/dl}$ ) was present in 46.4% of the children. On an average, dietary vitamin A intake of the children was found to be lower than the recommended allowance. Nutritional status of children with low and adequate retinol levels was compared and no statistical difference was obtained. The presence of high percentage of low serum retinol level may be one of the reasons responsible for increased child morbidity in these areas. Further study needs to be conducted to estimate vitamin A status in children all over Pakistan.

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The following monographs are published by the International Vitamin A Consultative Group:

- ▲ *Guidelines for the Eradication of Vitamin A Deficiency and Xerophthalmia* (1977) (Available in English and French)
- ▲ *Recent Advances in the Metabolism and Function of Vitamin A and Their Relationship to Applied Nutrition* (1979)
- ▲ *The Safe Use of Vitamin A* (1980) (Available in English and French)
- ▲ *The Symptoms and Signs of Vitamin A Deficiency and Their Relationship to Applied Nutrition* (1981) (Available in Spanish only)
- ▲ *Biochemical Methodology for the Assessment of Vitamin A Status* (1982)
- ▲ *Reprints of Selected Methods for the Analysis of Vitamin A and Carotenoids in Nutrition Surveys* (1982)
- ▲ *The Safe Use of Vitamin A by Women During the Reproductive Years* (1986) (Available in English, French, and Spanish)
- ▲ *Biochemical Methodology for the Assessment of Carotenes* (1987)
- ▲ *Guidelines for the Use of Vitamin A in Emergency and Relief Operations* (1988)
- ▲ *Vitamin A Supplements: A Guide to Their Use in the Treatment and Prevention of Vitamin A Deficiency and Xerophthalmia* (published by the World Health Organization in conjunction with IVACG and UNICEF, 1988) (Available in English and French)
- ▲ *Guidelines for the Development of a Simplified Dietary Assessment to Identify Groups at Risk for Inadequate Intake of Vitamin A* (1989)
- ▲ *Methodologies for Monitoring and Evaluating Vitamin A Deficiency Intervention Programs* (1989)

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