

Research and Measurement for Understanding and Reducing Malnutrition

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USAID's nutrition research has positioned the Agency to not only lead in shaping evidence-based policies, but to be at the forefront of innovative technology creation and scalable program development. This research has deepened the global understanding of the causes and consequences of malnutrition and provided proven, cost-effective solutions. USAID applies a systematic and coordinated "research-to-policy-to-programs" approach, which has translated research into large-scale applications that have significantly improved the nutritional status and survival of children. Advances in measuring individual and population-level malnutrition indicators provide indispensable data for decision-making, for revealing malnutrition's magnitude and for tracking the world's progress toward better nutrition for all. This chapter highlights some of USAID's major nutrition research and measurement contributions.¹

When USAID was created in 1961, modern nutrition science had only existed for three decades.² Nutrition science's primary paradigm then was identifying single nutrient deficiencies as the cause of nutrition-related problems. Severe types of child undernutrition³ were common, e.g. kwashiorkor and marasmus, with the primary cause believed to be protein deficiency. USAID initially responded to nutritional needs with food technology and plant breeding research intended to increase the quantity and quality of protein in staple foods, including the development of specialized food products.

U.S. universities, primarily, conducted USAID's early nutrition research. The vibrant and influential Committee on International Nutrition Programs of the National Academy of Sciences, established and supported by USAID from 1967 into the mid-1980s, organized the U.S. scientific community to advise USAID and the international nutrition community.⁴ According to Alan Berg, "in its day, this was probably the best science advisory group on nutrition anywhere."⁵ Over time, USAID's research increasingly involved investigators from local universities in developing countries (while also building their capacity), private agencies and foundations and

other international development organizations. Basic scientific research was complemented by implementation research in many countries and programs, which helped to adapt interventions to local contexts for more effective delivery and scale up.

USAID's research has also played a pivotal role in policy dialogue and advocacy, providing the evidence base to inform both sound decisions and the design and implementation of appropriate interventions and protocols. For example, USAID-funded intervention studies in Honduras showed that infants exclusively breastfed for 6 months experienced less diarrhea than those who began complementary feeding at 3 or 4 months along with continued breastfeeding to 6 months. Infants exclusively breastfed for 6 months also showed no growth deficits. This evidence played a decisive role in shaping WHO policy and recommendations to extend the optimal period of exclusive breastfeeding from 4 to 6 months.⁶

Nutrition research results are critical to advancing the work of country governments, foundations, United Nations agencies and NGOs. Other chapters in this history describe examples of research undertaken by USAID to develop and refine specific nutrition interventions and delivery systems.

Consequences of Marginal Malnutrition, an Underestimated Threat

USAID-supported research in the 1970s identified the devastating and ultimate consequence of moderate and severe underweight: death.⁷ Analyses conducted as part of the Narangwal study in the Indian Punjab showed that the risk of young children dying increased proportionally with the severity of underweight; the risks doubled with each 10 percent drop below the 80 percent cut-off point then used to designate low weight-for-age.⁸ The study also found that infections, especially diarrhea, were a major cause of children being underweight.



There was little known then about the consequences of the milder forms of malnutrition resulting from marginal energy deficiency. Could marginal malnutrition also adversely affect human functions? Skeptics argued that children small for their age were normal.

This knowledge gap was addressed substantially by the two largest longitudinal nutrition studies undertaken at that time in low- and middle-income countries. In Guatemala, one study (1969-1977), funded primarily by the U.S. National Institute of Child Health and Human Development with USAID supplemental support,⁹ tested the efficacy of food supplements for pregnant and lactating women and children under 3 years. A follow up effort (1988-2007) measured the long-term effects. The second study was USAID's Collaborative Research Support Program on nutrition and human function (1981-1992) in Egypt, Mexico and Kenya.¹⁰ In this study, data were collected for up to 2 years from pregnant and lactating women, newborns, infants and young and school-age children on dietary intake, growth, performance on psychological development tests, morbidity, and other health indicators.¹¹

One of the most critical findings of these studies was to show that growth faltering—or a slower rate of growth than expected for a child's age and

sex—starts early in life, and is accompanied by functional impairments.¹² Although low energy intake from lack of food was initially the central concern, the studies indicated that poor quality diets, deficient in vitamins and minerals, were likely more important contributors to growth faltering. The study by the Collaborative Research Support Program showed that impaired growth and development that occurs during this early period of life is responsible for small size later in childhood and most likely throughout life.¹³ Particularly important was the Guatemalan study finding that once a child was born, any growth faltering, and its accompanying adverse cognitive and behavioral effects, could be remedied only before a child's second birthday.¹⁴ Subsequent, long-term follow-up of the Guatemalan participants indicated that the observed, early nutrient deficits in young children resulted in substantial, negative consequences for the economic well-being of individuals in adulthood through reduced work capacity and intellectual performance.¹⁵

This important research guided USAID and the global nutrition community to focus on preventive approaches to malnutrition, especially during the first 1,000 days of life.

Harmful Effects of Undernutrition, Identified through USAID Research

In adults and women of childbearing age

- Increases risk of pregnancy complications
- Increases risk of spontaneous abortions, stillbirths, impaired fetal brain development, and infant deaths
- Increases risk of death from spontaneous abortion, stress of labor, and other delivery complications
- Increases the odds of having a low birth weight baby
- Increases risk for some infections, including HIV and reproductive tract infections
- Reduces wages
- Results in additional sick days and lost productivity



In infants and young children

- Diminishes ability to fight infection
- Impairs growth
- Increases chance of infant and young child mortality, leading to 45% of all <5 deaths
- Heightens fatigue and apathy
- Hinders mental development
- Reduces learning capacity

Source: Adapted from: Baker, J., L. Martin, and E. Piwoz. "A Time to Act: Women's Nutrition and its Consequences for Child Survival and Reproductive Health in Africa." SARA Project, December 1996.¹⁶



Health workers in India
in the 1970s
Photo Courtesy of USAID/
Food for Peace

Governance, Sustainability and the Cost of Food and Nutrition Programs

Beyond advancing research in nutrition science, USAID has also invested in research to look at critical aspects of nutrition programming and policy to ensure the effective implementation of evidence-based interventions.

Governance

Good governance is one factor that has been shown to be important in reducing stunting. An analysis of factors contributing to stunting reductions in 116 countries between 1970 and 2012 identified safe water access, sanitation, women's education, gender equality and quantity and quality of available food to be key drivers in past reductions of stunting. Good governance, along with income growth, played essential facilitating roles.¹⁷

USAID works to strengthen national nutrition programs in order to ensure good governance, resource tracking and accountability, and effective management and delivery of quality services at all levels.¹⁸ A country's National Nutrition Action Plan is usually the starting point for scaling up the coverage of essential nutrition services. The process and progress of action plans developed in Uganda, Nepal and Ethiopia were investigated

in 2015 by USAID's Feed the Future Nutrition Innovation Lab.¹⁹ The findings emphasized that good governance, effective financial decentralization and improved accountability were all critical for nutrition actions, including the need for improved human resources, implementation research to identify both successes and limitations, and routine monitoring to measure national policy and plan effectiveness.²⁰

Sustainability

Development projects are truly successful only when the benefits are sustained beyond their completion, without continued external resources. In 2006, Food for Peace began requiring that all development food assistance projects include explicit plans for ensuring the sustainability of activities and benefits after the project. From 2009 to 2016, USAID-supported research explored the sustainability of development food assistance project impacts in Bolivia, Honduras, India and Kenya after external support had ended. Four critical factors for sustainability were identified: continuing resources such as user fees or systems established to ensure replacement supplies; technical and managerial capacities; the motivation of beneficiaries and providers; and connections outside of the programs to support independent operations.²¹ Development food assistance projects now include actions to promote these four factors of sustainability.

Cost-effectiveness

To better inform decisions, improve program effectiveness, be accountable to stakeholders and support organizational and global learning, USAID has been investigating the cost-effectiveness of nutrition interventions since the early 1990s. USAID advanced the analysis of cost-effectiveness of nutrition interventions in Latin America from 1992 to 1995,²² for example, in studies that demonstrated the cost-effectiveness of breastfeeding promotion in maternity services in Brazil, Honduras and Mexico.²³ Breastfeeding promotion costs \$1 per diarrhea case averted and roughly \$150 per diarrhea death averted, comparing very favorably with alternative interventions, such as formula use, immunizations, oral rehydration therapy, and hygiene promotion. The importance of country context was also shown. In Guatemala, a comparison of the cost-effectiveness of improving vitamin A status (through supplementation, sugar fortification or home vegetable gardens with education on eating more of the produce) concluded that fortification could achieve adequate intake at less than half the cost per person of the alternatives.²⁴

Projecting costs is always important to intervention planning and budgeting, especially for more expensive services such as community-based management of acute malnutrition (detailed in Chapter 2). Therefore, USAID supported the development of a costing tool for governments and program managers to determine whether their plans for these services are financially viable, identify the resources needed and plan for effective implementation at the national, sub-national and district levels.²⁵ This tool was used in Ghana in 2013²⁶ and Malawi in 2016²⁷ to plan for national scale up of community-based management of acute malnutrition.



Health workers in Nepal measure a child's height as part of an assessment for nutritional status.

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Measuring Malnutrition

Surveillance Systems

In the late 1970s, the global nutrition community recognized the value of putting systems in place in countries to continually collect information on their nutrition situation. Ongoing surveillance systems were needed to collect, analyze and present timely and reliable nutrition information to engage local decision-makers and resource allocators. To help address this challenge, USAID first supported nutrition surveillance activities from 1980 to 1987.²⁸ The biggest contribution was developing standard methods for nutrition surveillance, which have since been adopted globally.²⁹ However, it was initially difficult to establish sustainable, country-level surveillance systems.³⁰

More than two decades later, a USAID review was able to document sustained and functioning nutrition surveillance systems run by government public health authorities in 12 countries across Latin America, Asia, Africa and the Middle East.³¹ In collaboration with USAID, the CDC has supported governments in Nicaragua, Guatemala, Uganda, Rwanda and Burkina Faso to strengthen nutrition surveillance with high quality, nationally representative, timely and low-cost data on key indicators for all large-scale nutrition programs.³² For example, in Guatemala, data are collected in continual, annual surveys on the nutritional status of women and children (including micronutrient status), infant and young child feeding practices and sugar, salt and wheat flour fortification levels.³³



A nurse in an antenatal care clinic in Jinja, Uganda measures the mid-upper arm circumference of a pregnant woman.

Kate Consavage/USAID

In addition to routine surveillance systems, the 1984 East Africa famine, during which more than 1 million people died, greatly stimulated interest in surveillance systems to better prepare for emergencies. An urgent need existed for accurate, early warning systems able to measure hunger, food insecurity and poor diets; such information is challenging to obtain in resource-constrained settings with complex and constantly changing food systems. Responding to this from 1985 forward, USAID's Famine Early Warning Systems Network (FEWS NET) has provided invaluable warnings by using both remote and on-the-ground methods to monitor the indicators that best predict, in real time, food shortages and other emergencies.³⁴ In 2018, 38 countries were benefiting from these predictions.

New Indicators

USAID has made important investments in nutrition measurement by collaborating with WHO and UNICEF to create, define and update global nutrition indicators. While implementing Food for Peace development and emergency food assistance in the 1990s, USAID began a long-term effort to create, test and deploy cost-effective and simple indicators on dietary quality and food insecurity. These indicators are now mandatory to measure

in both Food for Peace and Feed the Future programs. Significantly, indicators for food insecurity and diet quality, including the Household Hunger Scale and the Minimum Dietary Diversity for Women, whose development was facilitated by USAID, have been widely adopted by United Nations agencies, academics and NGOs, allowing for more standardized measurement in global nutrition programs.

USAID has also supported a multi-year effort, started in the early 2000s and led by WHO, to develop and reach consensus on a set of simple, valid and reliable indicators to measure infant and young child feeding practices.³⁵ These indicators have been integrated into multiple population-based surveys, including Demographic and Health Surveys and Multiple Indicator Cluster Surveys.

Anthropometry

USAID supports improved methods and indicators for assessing the nutritional status of individuals and the growth of children using anthropometry (measures such as weight, height and mid-upper arm circumference); these measurements are also used in surveys to determine



the prevalence of malnutrition in populations.³⁶ In fact, anthropometric indicators measured at the population level constitute the core of global nutrition reporting. Some advances (2012-2017) that USAID has supported include practical methods for adult anthropometry in resource-constrained field settings; for example, mid-upper arm circumference cut-off points assessed for accurately detecting acute malnutrition, and body mass index (BMI) reference tables and a tool developed for rapid and easy calculation: the BMI Wheel.³⁷

Surveys

In collaboration with the CDC, USAID initiated its support for national nutrition surveys in a number of countries in the 1970s and early 1980s. Since 1984, USAID pioneered the Demographic and Health Survey (DHS) Program, providing technical and financial assistance to governments for the implementation of more than 320 household and facility-based surveys in more than 90 countries across Africa, Asia, Latin America/Caribbean and Eastern Europe, as of 2018. The data collected have deepened and transformed the understanding of population, health and nutrition issues in low- and middle-income countries. Anthropometric measurement of nutritional status was first included in the DHS in 1986, and was quickly adopted as a core survey component, along with nutrition indicators on anemia, infant and young child feeding practices, vitamin A and iron supplementation and the presence of iodized salt in the household. In the early 2000s, the surveys began including dietary quality indicators.

The standardized, high-quality, and comparable DHS data are extensively used by governments, donors, researchers and civil society; they are vital to inform health and nutrition programming, policies, accountability, funding priorities and research. For many years, these surveys were the only reliable source for such information, and they remain the principal source. The DHS data allow comparisons within and across countries of nutrition and other indicators, and trend analysis over time.³⁸ The wide array of data collected on health, population, nutrition and household characteristics provides a wealth of information for exploratory research into the determinants of nutritional status. Through implementation of the DHS, USAID has also supported country ownership and local capacity in data collection and analysis. Widely recognized as a global good, as of 2018, the DHS Program was the largest and longest-enduring program of its kind.

USAID also uses survey data in developing powerful nutrition advocacy. For example, along with mortality and poor health outcomes, the substantial losses to economic productivity from stunting and anemia have been quantified for selected countries, and used for advocacy with the computer-based PROFILES tool. This tool estimates the potential returns on nutrition investments and the contributions of improved nutrition to human and economic development, using country-specific data.³⁹ Since 1993, PROFILES has been applied for nutrition advocacy in more than 30 low-income countries.⁴⁰

USAID has been a key partner in developing a number of survey methodologies, including SMART (Standardized Monitoring and Assessment of Relief and Transitions),⁴¹ launched in 2002 by an international network of organizations. The SMART methodology seeks to balance simplicity (for rapid assessment in emergencies) and technical soundness, drawing from the core elements of several methodologies. SMART focuses on measuring the nutritional status of children under 5 years and a population's mortality rate, indicators that are useful for prioritizing resources and monitoring whether the relief system meets the population's needs. Thus, SMART measures the overall impact of the relief response. SMART trainings have been conducted in over 30 countries globally, and one study showed that 32 countries in sub-Saharan Africa had implemented the SMART methodology between 2013 and 2015, which indicates a strong potential for harmonizing nutrition rapid assessment methods across the region.⁴²

Guided by the Agency's Evaluation Policy,⁴³ USAID makes evaluations a central part of its nutrition programming in order to inform decisions, improve program effectiveness, be accountable to stakeholders and support organizational and global learning. Surveys are important in the evaluation process. As projects start, surveys inform the design of activities to respond to the local context and status of the population at the baseline; periodic repeat surveys after implementation evaluate service performance and the impact on nutritional status when compared to a control group. Over time, USAID has increased its emphasis on strategic collaboration, continual learning and adaptive management, putting to work the wealth of data generated during project implementation, monitoring and evaluation. A robust learning agenda is central to USAID's multi-sectoral approach to nutrition and focuses on three key areas: (1) evaluating the impact of nutrition-specific and nutrition-sensitive activities on nutrition outcomes, (2) cost-effectively bringing proven interventions to scale and (3) identifying effective nutrition-sensitive interventions in other sectors.⁴⁴

The Future: Evidence for Implementation Strengthening

Throughout USAID's history, research and measurement have been foundational in shaping its nutrition strategies and programs. Guided by its Multi-Sectoral Nutrition Strategy, USAID will strive to further expand the nutrition evidence base, and to increase the generation and application of innovative practices, technologies and evidence-based approaches.⁴⁵ In addition to advancing the field of nutrition science, there is an increased focus on implementation research to determine the most productive nutrition-specific and nutrition-sensitive interventions and delivery mechanisms that can most cost-effectively provide the maximum coverage of interventions. The continued application of this research to nutrition programs into the future will contribute to saving more lives, and making those lives healthier and more productive.