

GOODBYE MDGS
.....
HELLO SDGs
.....

40 NUTRITION: CRITICAL FOR ACHIEVING THE NEW GLOBAL GOALS
.....

49 NUTRITION LEADERSHIP CAPACITY DEVELOPMENT
.....

54 THE FUTURE OF THE SUN MOVEMENT
.....

58 THE SUSTAINABLE DEVELOPMENT GOALS: THE ROLE OF ETHICS
.....

Contents

05	Guest Editorial Jane Badham	49	Reflections on Nutrition Leadership Capacity Development
08	Infograph Nutrition: at the Heart of the SDGs	54	The Future of the SUN Movement in Light of the Sustainable Development Goals
	Food for Thought	58	The Sustainable Development Goals: The role of ethics
10	Let us Not be Diverted From Our Great Cause	64	Back to the Future with the Global Goals
	Perspectives in Nutrition Science	68	Getting Locals to Eat More Vegetables in Mozambique
14	Integrating Formative Research into Nutrition Interventions		Obituary
17	Vitamin A Induces Long-Term Epigenetic Modifications in the Innate Immune System	70	D John Shaw (1934–2015)
21	Vitamin A and Epigenetic Modifications 1. Observations by Keith P West		The Bigger Picture
22	Vitamin A and Epigenetic Modifications 2. Observations by Charles B Stephensen	72	A Day in the Life of Tom Arnold
24	Conversion of Dietary Carotenoids and Vitamin A into Bioactive Retinoids: Exploring trails blazed by Jim Olson		Field Reports
32	The Challenges of Scaling Up Multiple Micronutrient Interventions	78	Anemia in Children Under 5 Years of Age in Cameroon: A silent burden at the core of a rural-urban rivalry
	The Global Nutrition Agenda	81	My Time as an Intern at <i>Sight and Life</i>
40	Nutrition: A Critical Pathway to the Achievement of the New Global Goals	83	Implementation of Multiple Irish Aid-Funded Orange Flesh Sweet Potato Projects
42	Transparency and Accountability for Improving Global Governance in Nutrition	87	United Nations 53rd Graduate Study Program
			Congress Reports
		90	Financing for Development: Mobilizing leadership and investment in nutrition
		95	Carotenoids Research Interaction Group (CARIG) 2015 Conference
		99	Nutrition in Africa at the Crossroads
		102	What's New
		120	Reviews & Notices
		122	Imprint Disclaimer

1 NO POVERTY

Good nutrition increases earning capacity



2 ZERO HUNGER

Good nutrition supports
productive lives





Welcome

Goodbye and Hello

I was thinking of the words “goodbye” and “hello,” which provide the theme for this issue of *Sight and Life* magazine, and realize that they are often emotionally loaded words: we tend to see goodbyes as sad and hellos as happy.

If one looks at their etymology, it is fascinating. Hello, hallo or hullo (there are multiple spellings) dates back to c. 1400 and is considered to possibly come from “holla, hollo,” a shout to attract attention and demand that the listener should come to a stop or cease what he or she is doing. It is said to have gained popularity as a common greeting when Alexander Graham Bell invented the telephone and it became necessary to have some form of greeting to use when answering it! Necessity is indeed the mother of invention. I loved the fact that telephone exchange operators used to be known as “hello girls.” As for goodbye, good bye or good-by (again, there are many forms), it seems simply to be a contraction of “God be with ye,” and dates from the late fourteenth century. It was used when someone was leaving, and its formation was influenced by the phrases “good day” and “good evening”.

How relevant this theme is to the magazine, as we enter the post-2015 era.

Goodbye to the Millennium Development Goals

Nutrition has come a long way since the Millennium Development Goals (MDGs) came into being in 2000 following the adoption of the United Nations Millennium Declaration. The eight goals meant that there was some level of focus of the world’s attention on the serious issues they aimed to address – poverty, hunger, gender equity, maternal and child health and HIV/AIDS, among others. Goals 1, 4 and 5 provided the nutrition community with a platform from which to proclaim their message and highlight the importance of nutrition.

It was a slow process, but nutrition has come to be recognized by the World Bank as being core to development, and we have seen its critical role underscored by the prestigious medical journal *The Lancet* and the respected Copenhagen Consensus. Nobel laureates, economists, high-profile politicians and even His Holiness the Pope have spoken up for nutrition. And now

we have the Scaling Up Nutrition (SUN) Movement, launched by US Secretary of State Hillary Clinton and Irish Foreign Minister Micheál Martin, that has really generated attention, commitments and actions. So there was some sense of sadness as we said goodbye to the opportunity the MDGs gave nutrition – a sadness compounded by the harsh reality that the world did not achieve the goals that were set and that, despite some progress being made, there is much work left unfinished.

.....

“Nutrition has come a long way since the Millennium Development Goals (MDGs) came into being”

.....

Hello to the Sustainable Development Goals

Thus the “hello” to the 17 Sustainable Development Goals (SDGs) and all that they mean for nutrition in the post-2015 era is also poignant. In the true meaning of the word, this injunction requires that we come to a stop or cease what we have been doing. It requires us to look back at what we have achieved and to be open about where, how and why we have failed. And then to move forward with innovations that attract new and revitalized attention and action for nutrition.

This issue of the magazine is filled with interesting reading that looks both backward (goodbye) and forward (hello). The infographic is a good place to start in internalizing the link between the SDGs and nutrition: it depicts how improved nutrition is at the heart of the SDGs, either as an essential input or as a positive outcome. The articles by Jessica Johnston and Jerome Singh address the ever relevant topics of transparency, accountability and ethics. The role of financing and engagement with the private sector is also covered. All these, together with Johann Jerling’s article on the need for investments in leadership development, drive home the message of how critical it is to do things differently in the post-2015 era if we are to succeed. It is also good to read how internships and graduate programs are developing the capacity of the up-coming generation – something we must nurture and develop.

.....

“We must do things differently in the post-2015 era if we are to succeed”

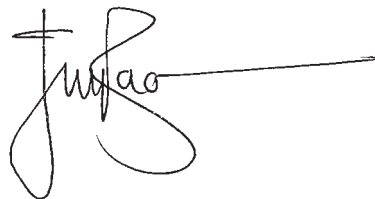
.....

The article by Stephen Kodish highlights why undertaking formative research before we jump into programs is crucial, as one size certainly does not fit all. We have to truly understand those for whom we are working; they cannot be a mere afterthought. The perspective by Zlotkin et al. is a wonderful reminder of the advances we have made in evidence-based interventions and yet how complex scale-up is in reality. And the article by Rob Arts and Christine Benn, with its two associated opinion pieces, reminds us that there will always be debate and

discussion on nutrition interventions, but that we must remain firmly grounded in scientific rigor and be careful when promoting policy changes.

At this point of “Goodbye, Hello,” there is little doubt in my mind that we must move from talk to action, from our focus on efficacy to a passion for scale-up and implementation. We must all become the telephone exchange operators for nutrition, like the “hello girls” of days gone by – the point where new ideas and ways of doing things are linked with new partners and programs. We also need to be the innovators. In the words of Alexander Graham Bell, *“Sometimes we stare so long at a door that is closing that we see too late the one that is open.”* So as we bid goodbye to the MDGs, let us say hello to the SDGs and all the opportunities they bring and, as Alexander Graham Bell also said, *“Concentrate all [our] thoughts upon the work at hand. The sun’s rays do not burn until brought to a focus.”*

With warm regards,

A handwritten signature in black ink, appearing to read 'Jane Badham', with a long horizontal line extending to the right.

Jane Badham
Sight and Life, Africa Office

3

GOOD HEALTH AND WELL-BEING

.....
Good nutrition makes
for good health
.....





Good nutrition increases earning capacity

Good nutrition supports productive lives

Good nutrition makes for good health

Good nutrition drives up IQ levels

- Nutrition is a vital precondition for achieving these goals
- Achieving these goals supports nutrition

NUTRI



\$1

at the heart Every \$1 invested

Partnership is key to improving nutrition

Ending malnutrition supports stable societies

Sustainable food production can improve nutrition

Healthy dietary choices can be good for the planet



5 GENDER EQUALITY

Good nutrition supports women's development

6 CLEAN WATER AND SANITATION

50% of malnutrition is linked to poor sanitation

7 AFFORDABLE AND CLEAN ENERGY

Essential for producing food and thus nutrition

8 DECENT WORK AND ECONOMIC GROWTH

0.9% of GDP is lost to iron deficiency alone

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Essential for innovations to improve nutrition

TION

of the SDGs

gives \$16 return



Almost 50% of countries experience malnutrition

10 REDUCED INEQUALITIES

Seasonal effects influence nutritional status

Reliable food supply helps stabilize food prices

Malnutrition is widespread in slums | shanty towns

11 SUSTAINABLE CITIES AND COMMUNITIES

13 CLIMATE ACTION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Let us Not be Diverted From Our Great Cause

Klaus Kraemer

Sight and Life, Basel, Switzerland

I am writing this commentary in the wake of the horrific terrorist attacks that occurred in Paris on 13 November 2015, in which, at the last count, at least 130 people were murdered and many more severely injured.

We have all been deeply shocked by these events, and our deepest sympathies go to the victims and their families. Religious extremism of the terrorist group calling itself Islamic State (ISIS) has brought to our doorstep in central Europe the indiscriminate slaughter and measureless grief which are already a tragic reality for many Asian, Middle-Eastern and African countries.

Some observers draw parallels between the Paris massacres and the horrifying 2008 Taj Mahal Hotel attack in Mumbai, in which 164 were slain. According to Bruce Riedel of the Brookings Institution, “Mumbai has been studied by both terrorists and counter-terrorists because it set a gold standard for how a small group of suicidal fanatics can paralyze a major city, attract global attention, and terrorize a continent.”¹

For France, this is already the third terrorist incident following the Charlie Hebdo/Jewish supermarket and Thalys train attacks of 2015. And now Bamako, Lebanon and Port El Kantaoui in Tunisia, and who knows what might follow ... This fresh wave of assaults is the culmination of an extensive series of suicide bombings, shootings, downings of aircraft and hostage-takings that have been perpetrated ever since 9/11. I must confess that I have lost count of the plethora of atrocities committed by al-Qaeda, Islamic State, Boko Haram and the numerous offshoots of these terrorist groupings in recent times. Wikipedia lists 298 individual attacks from 1 January to 20 November 2015 alone.

2014 saw the highest death toll from terrorism ever: 32,658 people lost their lives, an 80% increase from 2013, according to the 2015 Global Terrorism Index.² A mere five countries – Afghanistan, Iraq, Nigeria, Pakistan and Syria – account for 78%

of all these deaths. Violence and displacement have caused a huge upsurge of hungry and malnourished people in these parts of the world. Two thirds of all stunted children – 112 million – live in conflict-torn areas, where rates of child stunting have also been decreasing more slowly than elsewhere in the world, according to the 2014–15 IFPRI Global Food Policy Report.³

Yet even as I record these appalling statistics, let me not forget all the truck drivers and other committed personnel working for the WFP, UNHCR, UNICEF and countless NGOs who risk life and limb by providing food assistance and other services to innocent people who have been forced to flee their homes by terrorism and violence. These courageous individuals are continuing with their efforts undeterred, and they set an example to us all.

The relationship between deprivation and violence is a complex and intimate one, both timeless and topical. Writing in 2013, Joachim von Braun (Director of the Center for Development Research [ZEF] and Professor for Economic and Technological Change at the University of Bonn, Germany) observed: “Dramatic increases – or ‘spikes’ – in the cost of commodity foods have not only impoverished the diet and constrained the possibilities of many of the world’s poorest and most vulnerable populations; they have in some instances actually led to food riots which have triggered major political and societal changes. The ‘Arab Spring’ that commenced on 18 December 2010 had complex causes, but food prices did play some role in triggering the violent change.”⁴

Just two years later, and shortly before I commenced work on this commentary, Richard Horton, Editor-in-Chief of *The Lancet*, observed: “If the 20th century was the Age of War, what is the 21st century? It is the Age of Fear. As our French neighbors mourn their dead,” Horton continues, “and as our human family sees civilizations destroyed, from Syria to Somalia, we know that terrorism is designed with one objective only – to trigger epidemics of fear.”⁵ In a brave and stirring editorial, Horton points out the irony that, despite these many horrors, “the dominant discourse in global health today, as summed up in the Sustainable Development Goals (SDGs), is unremittingly utopian.”



This issue of *Sight and Life* is dedicated to the SDGs, which were launched at the United Nations Sustainable Development Summit held in New York in September of 2015. In the face of the terrible events of recent months, we might well be tempted to give in to fear; and in a state of fear, it is hard to devote one's attention to the diligent implementation of carefully elaborated policies and programs, howsoever well-intentioned these might be. We may even have to accept terror and violence as the new normal and work around it.

Yet implementing the SDGs is precisely what the nutrition community needs to do at the moment. However many factors may be influencing the current global wave of terror – from social inequity at one end of the scale to group blood lust at the other – we know that poor nutrition creates fragile societies. And we know that fragile societies can easily fragment into broken states, and that broken states provide the ideal breeding-ground for terrorists – people whose worldview is as borderless as it is nihilistic.

Our day-to-day work as nutritionists will not disable any Kalashnikovs or defuse any suicide belts; it will not uncover any terrorist plans in the making and foil them before they can be put into practice. But it can, little by little and bit by bit, help to eliminate some of the conditions which encourage people to pick up Kalashnikovs and strap on suicide belts.

In a recent budget review, the British government announced that at least half the UK's £12bn (US\$ 18bn) aid budget will be spent on supporting fragile and failing states. In the circumstances, one can comprehend the swiftness and decisiveness of this move. If it sets a trend, however, then development budgets worldwide may undergo radical transformation, and this change may make it far harder for us to do our essential work in many parts of the world. Horrific as the recent terrorist attacks have been, we must not allow them to destabilize our work of improving the nutritional status of all populations in need, wherever they might be in the world.

Equitable, just and stable societies are those in which everyone *has enough of the right kind of food* to eat – societies in which the most essential ingredients for peace are education and healthcare for all. As we mourn the victims of the Paris massacres, and the victims of all terrorist atrocities of the 21st century, let us remember that – just like those brave truck drivers who selflessly bring food to those who most urgently need it – we have an important job to do, and that we are building a more peaceful world with every day's work. Let us as the nutrition community stay on course and not be diverted from our purpose. We have a great cause. We must never allow the threat of terror to weaken our resolve to fight for a world free from malnutrition.

.....
Correspondence: Klaus Kraemer,

Sight and Life, PO Box 2116, 4002 Basel, Switzerland

Email: info@sightandlife.org

References

01. Bruce Riedel, Modeled on Mumbai? Why the 2008 India attack is the best way to understand Paris, November 14, 2015, www.brookings.edu/blogs/markaz/posts/2015/11/14-paris-attacks-mumbai-isis-terrorism-riedel.
02. <http://economicsandpeace.org/wp-content/uploads/2015/11/Global-Terrorism-Index-2015.pdf>
03. www.ifpri.org/topic/global-food-policy-report
04. The Road to Good Nutrition: A Global Perspective. Basel, Switzerland: Karger, 2013.
05. www.thelancet.com Published online November 16, 2015 [http://dx.doi.org/10.1016/S0140-6736\(15\)00993-9](http://dx.doi.org/10.1016/S0140-6736(15)00993-9) 1.

4 QUALITY EDUCATION

Good nutrition drives up IQ levels



Integrating Formative Research into Nutrition Interventions

Using micronutrient powders (MNP) within an integrated IYCF program in northern Nigeria

Lead Author: Stephen Kodish

UNICEF, Abuja, Nigeria

**Co-Authors: Stanley Chitekwe, Annette Imohe,
Pragya Mathema, Tobi Osunkentan and Arjan de Wagt**

UNICEF, Abuja, Nigeria

Chris Osa Isokpunwu

Nigerian Federal Ministry of Health, Abuja, Nigeria

Addressing Sustainable Development Goal 2

With the new Sustainable Development Goals (SDGs) just having been adopted, the Nigerian Federal Ministry of Health (FMOH) and partners have begun ambitious work to address **goal number 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.**^{1,2} In Nigeria, 37% of children under five suffer from stunting³ and 76% of pre-school-aged children live with iron-deficiency anemia.⁴ To improve this nutrition situation, in 2013, the Nigerian FMOH adopted a World Health Organization global recommendation to use micronutrient powder (MNP) for home fortification as a strategy to address micronutrient deficiencies, especially among children up to 23 months.^{5,6} Systematic review evidence from past effectiveness and efficacy trials in similar settings illustrates that the use of MNP supplementation in young children can reduce anemia by up to 31% and iron deficiency anemia by up to 51%.⁷

As part of the global Scaling Up Nutrition (SUN) Movement, the FMOH has developed a costed national nutrition plan with support from the UK Department for International Development (DFID). It includes MNP as a key intervention for scale-up. Also in northern Nigeria, funding support has been provided by DFID, the FMOH, UNICEF, Save the Children, and Action Against Hunger/ACF International in order to collaboratively implement “*Working to Improve Nutrition in Northern Nigeria (WINNN)*,” which is an integrated nutrition program aimed at improving the nutritional status of 11 million children in five northern states. The initiative delivers critical interventions, such as state-wide provision of micronutrients (e.g., vitamin A and iron) through the bi-annual Maternal Newborn and Child Health Week, promotion of IYCF

Editor's note

Issue 2 | 2014 of *Sight and Life* featured a contribution entitled “Home Fortification with Micronutrient Powders: Lessons learned from formative research across six countries.” In it, Judy McLean and her co-authors noted that “Formative research prior to implementing home fortification with micronutrient powders (MNP) is imperative for guiding successful implementation and scale-up.” They also observed that: “Information is needed on country-specific Infant and Young Child Feeding (IYCF), particularly complementary feeding, food availability, common beliefs and practices,” adding that: “Acceptability, compliance, and willingness to continue using MNP are very high where caregivers are well informed and given simple, adaptable options in local circumstances.”

The present article outlines an excellent example of such formative research.

and Community-Based Management of Acute Malnutrition, as well as advocacy for scalability and sustainability.

.....

“Working to Improve Nutrition in Northern Nigeria aims to improve the nutritional status of 11 million children”

.....

Creating an enabling environment for IYCF practices and MNP usage

In response to evidence highlighting the importance of formative research for effective nutrition programming with behavior change,^{8–12} UNICEF Nigeria assisted the Government in conducting a robust formative study in Kebbi and Adamawa – the first two states where the integrated IYCF and MNP program will commence in 2016. Developing an at-scale nutrition program which attempts to change nutrition-related behaviors is no easy task in Nigeria, where myriad cultural groups and nearly 500 languages co-exist within state borders.¹³ To increase the likelihood of program success, this European Union funded formative phase was comprehensive and included qualitative and ethnographic data collection in both Kebbi and Adamawa covering multiple, iterative research phases over a nine-month period (Table 1). The study was designed with participatory, open-ended methods for collecting socio-cultural and contextual information in order to create an enabling environment for optimizing IYCF practices and MNP usage.



Musa, the first child 6–23 months in an IDP camp to receive food fortified with MNP.

Findings from the formative phase were recently presented in a multi-sectoral stakeholder dissemination meeting in Abuja. They revealed important socio-cultural information among cultural groups of Kebbi and Adamawa, as well as the multi-level barriers and facilitating factors to the health-seeking behaviors of interest around IYCF and MNP home fortification. Specifically, findings highlighted salient community perceptions and behaviors in several domains, including but not limited to: Childhood Illness, IYCF Practices, MNP Uptake and Utilization, and Communications: Social Marketing an MNP. By including an eight-week home-feeding trial with MNP, the study was able to elucidate key determinants of MNP utilization, as well as the high level of early product acceptance. This formative work may represent one of the most comprehensive efforts for developing an integrated MNP nutrition intervention to date. Preliminary data suggest that MNP is appropriate for this setting, with high community appreciation.

The formative research has already helped the country to design emergency distribution of MNP to approximately 1.3 million internally displaced families in the three northeast Nigerian States of Adamawa, Borno, and Yobe that have been affected by the Boko Haram insurgency.

Specifically, these findings were used to develop a culturally appropriate behavior change communication strategy and materials to enhance the likelihood of MNP acceptability and appropriate utilization.¹¹ In the coming months, a large-scale pilot trial will be implemented to test the effectiveness of various MNP delivery mechanisms and to identify the most cost-effective approach that maximizes coverage, while ensuring equitable reach. Based on the lessons learned, a costed national plan will



Nigerian caregivers voting in a participatory community workshop during formative research.

TABLE 1: Formative research data collection efforts by method used

Research Method	Kebbi	Adamawa	Total
In-depth interviews	66	60	126
Community workshops	12	12	24
Direct observations	18	24	42
Free lists	41	40	81
Spot checks	44	45	99
Pile sorts	33	35	68
Surveys	45	38	83

then be developed to progressively scale up the intervention by 2018 – part of multi-sectoral collaboration among Government and donors, as well as public and private partners.

.....

“Chronic malnutrition remains an enduring problem in Nigeria. Eleven million children under 5 suffer from stunting. Almost 22 million children are anemic. This warrants urgent attention.”

Chris Osa Isokpunwu

Head of Nutrition, Nigeria FMOH and SUN Focal Point

.....

Indeed, other countries will also benefit from Nigeria’s evidence-based program experiences. Sharing experiences, successes, and failures will be important as we in the international nutrition community move towards scaling up and delivering on the ambitious SDG goals and targets, while striving to ensure that nutrition remains high on the global health agenda.

.....

Correspondence: *Stephen Kodish,*

23 Sidney St. Cambridge, MA 02139, USA.

Email: *skodish1@jhu.edu*

.....

References

01. United Nations [Open Working Group of the General Assembly]. Open Working Group Proposal for Sustainable Development Goals, 2014. A/68/970 2015; Accessed on October 1, 2015 at <http://undocs.org/A/68/970>.
02. Maurice J. UN set to change the world with new development goals. *Lancet* 2015;386:1121–24.
03. National Population Commission (NPC) [Nigeria] and ICF International. Nigeria Demographic and Health Survey 2013. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF International, 2014.
04. Micronutrient Initiative [MI]. Investing in the Future: A United Call to Action on Vitamin and Mineral Deficiencies: Global Report 2009; Accessed on October 5, 2015 at www.unitedcalltoaction.org/documents/Investing_in_the_future.pdf.
05. Nigeria Federal Ministry of Health [FMOH]. National Guidelines on Micronutrients Deficiency Control in Nigeria. Abuja: FMOH. 2013.
06. WHO. Guideline: Use of multiple micronutrient powders for home fortification of foods consumed by infants and children 6–23 months of age. Geneva: World Health Organization 2011; Accessed on September 20, 2015 at http://apps.who.int/iris/bitstream/10665/44651/1/9789241502047_eng.pdf.
07. De-Regil LM, Suchdev PS, Vist GE et al. Home fortification of foods with multiple micronutrient powders for health and nutrition in children under two years of age. *Cochrane Database Syst Rev* 2011;(9):CD008959. doi: 10.1002/14651858.CD008959.pub2.
08. Bentley ME, Johnson SL, Wasser H et al. Formative research methods for designing culturally appropriate, integrated child nutrition and development interventions: an overview. *Ann NY Acad Sci* 2014;1308(1):54–67.
09. Ejigui J, Lezama I, Bissek A et al. Formative Research: A Necessary Step for the Implementation of a Home Fortification Program in Cameroon. *EJNFS* 2015;5(5):975–976.
10. Fabrizio CS, Liere M, Pelto G. Identifying determinants of effective complementary feeding behavior change interventions in developing countries. *Matern Child Nutr* 2014;10:575–592.
11. Kodish S, Rah JH, Kraemer K et al. Understanding low usage of micronutrient powder in the Kakuma Refugee Camp, Kenya: Findings from a qualitative study. *Food Nutr Bull* 2011;32(3):292–303.
12. Sutér M, Omwega A, Brunet D et al. Formative Research to Guide Successful Scale-Up of Micronutrient Powder Programmes: Lessons Learned From a 4 Country Comparison. *EJNFS* 2015;5(5):792–793.
13. Ayeomoni, MO. The languages in Nigerian socio-political domains: Features and Functions. *ELT Journal* 2012;78:12.

Vitamin A Induces Long-Term Epigenetic Modifications in the Innate Immune System

Rob JW Arts

Department of Internal Medicine, Radboud University Medical Center, Nijmegen, The Netherlands

Christine Stabell Benn

Research Center for Vitamins and Vaccines (CVIVA), Statens Serum Institut, Copenhagen, Denmark and OPEN, Odense Patient data Explorative Network, Odense University Hospital | Department of Clinical Research, University of Southern Denmark

Vitamin A supplementation

High-dose vitamin A supplementation (VAS) programs targeting 6–60-month-old children are carried out in more than 100 countries at risk of vitamin A deficiency (VAD). The aim is to provide

VAS every 4–6 months; since vitamin A is a fat-soluble vitamin which is stored in the liver, it is believed that the high doses ameliorate existing VAD and also act as a depot of vitamin A to prevent VAD and its complications.

The VAS policy is based on randomized trials conducted in the late 1980s and early 1990s, before a vaccination program was widely implemented, showing that a high dose of vitamin A administered to children aged 6–60 months led to significantly lower mortality.¹ However, more recent trials have suggested that this may no longer be the case.^{2,3} Intriguingly, one of these trials – an individually randomized placebo-controlled trial – suggested that the effect may differ by sex, being very beneficial in females, who had 55% (95% CI=13-76%) lower mortality after VAS compared with placebo, but not in males, who had 92% (-2-275%) higher mortality after VAS.³ Since it is estimated that high-dose VAS would reduce overall child mortality by 24%,⁴ the lack of overall effect in these recent trials is striking, and at a first attempt hard to explain.

Additionally, though some trials have indicated that neonatal vitamin A supplementation (NVAS) may lower overall mortality in infants up to 6 months of age,⁵⁻⁷ other recent trials, many with longer follow-up, have indicated that NVAS may be associated with a tendency for increased mortality, especially in females, and with increasing length of follow-up.⁸⁻¹³ A meta-analysis of trials with follow-up to 12 months of age showed that from 6–12 months of age NVAS versus placebo was associated with 20% (2%–42%) significantly increased mortality in females.¹⁴

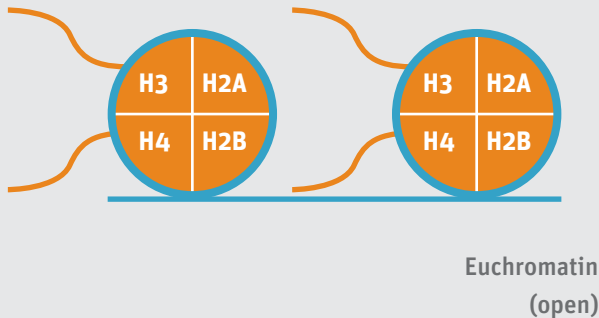
We have proposed a common explanation for these findings: The high doses of vitamin A interact with the routine vaccines in a sex-differential manner, being beneficial for females who have a live vaccine such as BCG or measles vaccine as their most recent vaccine, but negative for females who have diphtheria-tetanus-pertussis (DTP)-containing vaccines as their most recent vaccine.¹⁵⁻¹⁷ This would explain why VAS is beneficial for females from 6 months of age and onwards, where measles



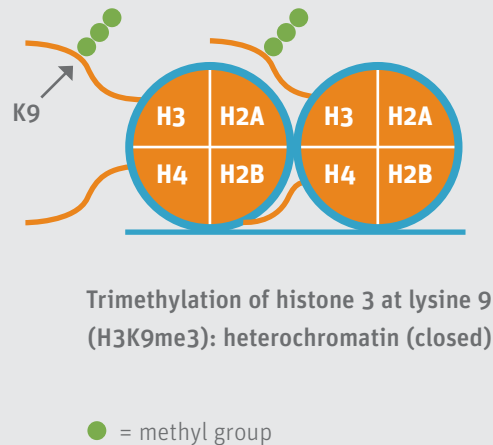
A child receiving a vitamin A supplement in Guinea-Bissau.

FIGURE 1: When monocytes are incubated with all-*trans* retinoic acid (ATRA), promoters of important immunological mediators (e.g., cytokines such as TNF) become marked with three methyl groups at lysine 9 at the tail of histone 3 (H3K9me3), which is a repressive histone mark. This histone mark induces heterochromatin, which makes genes present at these locations less accessible and therefore less transcribed.

A. Before ATRA treatment:



B. After ATRA treatment:



vaccine is the dominating vaccine, but associated with negative effects in females when given at birth and shortly after followed by DTP-containing vaccines.

.....
“We propose that high doses of vitamin A interact with the routine vaccines in a sex-differential manner”

To explain these effects we hypothesized that VAS not only restores vitamin A levels in the human body, but could also lead to long-lasting effects on the immune system and the way it handles vaccines and infectious disease challenges.

Vitamin A and the immune system

The short-term or direct effects of vitamin A on the immune system are well described. In general, vitamin A has an inhibitory effect on both the innate and adaptive immune system, by down-regulating pathogen recognition receptors and important intracellular signaling cascades, reducing the production of soluble signaling molecules such as cytokines and prostaglandins, and inhibiting the maturation and differentiation of certain immune cells.¹⁸ However, these are all direct effects of vitamin A and its metabolites on the immune system. The question as to whether a high dose in children would lead to longer-lasting effects on

the immune system, whether beneficial or negative, has not been addressed.

Potential long-term effects of vitamin A supplementation

The long-term immunological effects of a health intervention are not an unknown phenomenon. Comparisons with other large-scale prevention policies, such as vaccination regimes, might serve to raise hypotheses. For example, for BCG vaccine it has been shown that apart from preventing tuberculosis infection, the vaccine also has secondary so-called “non-specific” effects. In observational studies and later in two RCTs it was shown that BCG provided early in life prevents mortality from other non-related infectious diseases, especially from lower respiratory infections and sepsis.^{19,20} The immunological mechanisms behind the non-specific effect of BCG have not been known. However, recently, in a proof-of-concept study in healthy volunteers, it was shown that the BCG vaccine induced long-term epigenetic changes in the monocytes after vaccination, so-called “trained innate immunity.” These epigenetic changes made monocytes more capable of reacting to pathogens.^{21,22} This provided a plausible mechanism for the reduction in all-cause mortality in BCG-vaccinated children. Indeed, in Guinean children, we found that those randomized to BCG at birth mounted stronger *in-vitro* cytokine responses upon unrelated innate stimulation than those who had not yet received BCG.²³

A hypothesis for the potential long-term negative effects of vitamin A on the immune system could be adapted from the

effects observed from BCG vaccination. We therefore hypothesized that vitamin A could also induce epigenetic changes in monocytes, leading to a long-term decrease in the function of monocytes and therefore increased mortality from infections. We tested this in a series of experiments which were recently published in the *Journal of Leukocyte Biology*.²⁴

.....

“We hypothesized that vitamin A could also lead to long-term decrease in the function of monocytes”

.....

Vitamin A induces long-term epigenetic changes in monocytes

To address this hypothesis, we performed several *in-vitro* experiments on isolated human monocytes.²⁴ Incubation of monocytes with all-*trans* retinoic acid (ATRA), the most abundant metabolite of vitamin A, resulted in decreased cytokine production of monocytes a week after incubation with ATRA. Analysis of the epigenome of the cultured monocytes revealed epigenetic changes at the promoter sites of important signaling molecules of monocytes. Epigenetic changes can be considered as a long-term memory. The epigenetic modifications induced by ATRA in monocytes led to an epigenetic make-up of these monocytes that makes them less capable of reacting to pathogens effectively in our *in-vitro* system. Monocytes that had been primed with ATRA for 24 hours and were stimulated with a panel of different pathogens a week later were less capable of mounting a cytokine response (Figure 1). Interestingly, the addition of ATRA to BCG inhibited the epigenetic innate training effects of BCG, showing that these two interventions interacted with effects on the immune system.²⁴

The translation from our *in-vitro* system to supplementation policies is of course still a big step, but an important one to make. Our *in-vitro* experiments support the hypothesis that vitamin A can induce long-lasting functional changes in monocytes and macrophages. Thus, apart from its benefit to vitamin A status, VAS may also have a detrimental effect on the innate immune system, which might lead to higher mortality rates. These findings might fit with the varying effect of VAS on mortality seen over time (with decreasing effects of VAS on overall mortality over time, as the vaccination program was widely implemented, and the prevalence of pathogens encountered may have changed too), and depending on vaccines received. In other words, depending on the challenges the immune system faces at the time of VAS, the effect of VAS may be beneficial, but it may sometimes also be harmful.

How to continue?

A very important question that needs to be answered is whether VAS also leads to a long-term down-regulation of the function of monocytes *in vivo*. This question could be addressed by performing functional analyses on white blood cells of, in the first instance, healthy volunteers, and possibly later of babies or children that have received VAS, to assess whether the epigenetic make-up and the function of the immune system has changed after supplementation. If this is indeed the case, then lowering the supplementation dose should be considered. Another important question that remains to be answered is why VAS should have divergent effects in males and females depending on vaccination status – a pattern seen for VAS but also for other micronutrients.²⁵

In conclusion, large-scale VAS programs may no longer have the effect on mortality that they were hoped to have. The dampening effect on monocyte function observed in our human *in-vitro* model might also occur in the *in-vivo* situation. These long-lasting negative effects on the innate immune system could counteract the beneficial effects of restoring vitamin A levels.

.....

Correspondence: Rob JW Arts,

Department of Internal Medicine, Radboud University Medical Center, Geert Grooteplein Zuid 10, 6525 GA Nijmegen, The Netherlands **Email:** rob.jw.arts@radboudumc.nl

.....

References

01. Beaton GH, Martorell R, L'Abbe KA et al. Effectiveness of vitamin A supplementation in the control of young child morbidity and mortality in developing countries. Final report of the Canadian International Development Agency. Toronto: University of Toronto, 1993.
02. Awasthi S, Peto R, Read S et al. Vitamin A supplementation every 6 months with retinol in 1 million pre-school children in north India: DEVTA, a cluster-randomised trial. *Lancet* 2013;381(9876):1469–77.
03. Fisker AB, Bale C, Rodrigues A et al. High-dose Vitamin A With Vaccination After 6 Months of Age: A Randomized Trial. *Pediatrics*. 2014;134(3): e739–48.
04. Mayo-Wilson E, Imdad A, Herzer K et al. Vitamin A supplements for preventing mortality, illness, and blindness in children aged under 5: systematic review and meta-analysis. *BMJ* 2011;343:d5094.
05. Humphrey JH, Agoestina T, Wu L et al. Impact of neonatal vitamin A supplementation on infant morbidity and mortality. *J Pediatr* 1996;128:489–96.
06. Klemm RDW, Labrique AB, Christian P et al. Newborn Vitamin A Supplementation Reduced Infant Mortality in Rural Bangladesh. *Pediatrics*. 2008;122(1):e242–e50.
07. Rahmathullah L, Tielsch JM, Thulasiraj RD et al. Impact of supplementing newborn infants with vitamin A on early infant mortality: community based randomised trial in southern India. *BMJ* 2003;327(7409):254–0.

08. Benn CS, Diness BR, Roth A et al. Effect of 50,000 IU vitamin A given with BCG vaccine on mortality in infants in Guinea-Bissau: randomised placebo controlled trial. *BMJ* 2008;336:1416–20.
09. Benn CS, Fisker AB, Napirna BM et al. Vitamin A supplementation and BCG vaccination at birth in low birthweight neonates: two by two factorial randomised controlled trial. *BMJ* 2010;340:c1101.
10. Benn CS, Diness BR, Balde I et al. Two Different Doses of Supplemental Vitamin A Did Not Affect Mortality of Normal-Birth-Weight Neonates in Guinea-Bissau in a Randomized Controlled Trial. *J Nutr* 2014;144(9):1474–9.
11. Masanja H, Smith ER, Muhihi A et al. Effect of neonatal vitamin A supplementation on mortality in infants in Tanzania (Neovita): a randomised, double-blind, placebo-controlled trial. *The Lancet* 2015;385:1324–32.
12. Edmond KM, Newton S, Shannon C et al. Effect of early neonatal vitamin A supplementation on mortality during infancy in Ghana (Neovita): a randomised, double-blind, placebo-controlled trial. *The Lancet* 2015;385:1315–23.
13. Mazumder S, Taneja S, Bhatia K et al. Efficacy of early neonatal supplementation with vitamin A to reduce mortality in infancy in Haryana, India (Neovita): a randomised, double-blind, placebo-controlled trial. *The Lancet* 2015;385:1333–42.
14. Benn CS, Aaby P, Fisker AB. Neonatal vitamin A: time to move on? *Lancet* 2015;386:132–3.
15. Benn CS, Bale C, Sommerfelt H. Hypothesis: Vitamin A supplementation and childhood mortality: amplification of the non-specific effects of vaccines? *Int J Epidemiol* 2003;32(5):822–8.
16. Benn CS. Combining Vitamin A and Vaccines: Convenience or Conflict? *Dan Med J* 2012;59(1):B4378.
17. Benn CS, Aaby P, Arts RJ et al. An enigma: why vitamin A supplementation does not always reduce mortality even though vitamin A deficiency is associated with increased mortality. *Int J Epidemiol* 2015;44(3):906–18.
18. Tsai YC, Chang HW, Chang TT et al. Effects of all-trans retinoic acid on Th1- and Th2-related chemokines production in monocytes. *Inflammation* 2008;31(6):428–33.
19. Aaby P, Roth A, Ravn H et al. Randomized trial of BCG vaccination at birth to low-birth-weight children: beneficial nonspecific effects in the neonatal period? *J Infect Dis* 2011;204(2):245–52.
20. Biering-Sorensen S, Aaby P, Napirna BM et al. Small randomized trial among low-birth-weight children receiving bacillus Calmette-Guerin vaccination at first health center contact. *Pediatr Infect Dis J* 2012;31(3):306–8.
21. Kleinnijenhuis J, Quintin J, Preijers F et al. Long-lasting effects of BCG vaccination on both heterologous Th1/Th17 responses and innate trained immunity. *J Innate Immun* 2014;6(2):152–8.
22. Kleinnijenhuis J, Quintin J, Preijers F et al. Bacille Calmette-Guerin induces NOD2-dependent nonspecific protection from reinfection via epigenetic reprogramming of monocytes. *Proc Natl Acad Sci USA* 2012;109(43):17537–42.
23. Jensen KJ, Larsen N, Biering-Sorensen S et al. Heterologous Immunological Effects of Early BCG Vaccination in Low-Birth-Weight Infants in Guinea-Bissau: A Randomized-controlled Trial. *J Infect Dis* 2015 Mar 15;211(6):956–67. doi: 10.1093/infdis/jiu508. Epub 2014 Sep 9.
24. Arts RJ, Blok BA, van Crevel R et al. Vitamin A induces inhibitory histone methylation modifications and down-regulates trained immunity in human monocytes. *J Leukoc Biol* 2015;98(1):129–36. doi: 10.1189/jlb.6AB0914-416R. Epub 2015 May 1
25. Benn CS, Lund S, Fisker A et al. Should infant girls receive micronutrient supplements? *Int J Epidemiol* 2009;38(2):586–90.

Vitamin A and Epigenetic Modifications

1. Observations by Keith P West, Jr.

Keith P West, Jr.

Center for Human Nutrition Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

Arts and Benn hypothesize that early-life supplemental vitamin A may affect nutritional programming of the immune system, an established concept¹ being tested for vitamin A in animals,² *in-vitro* systems,³ and randomized cohorts.⁴ While an important scientific quest, Arts and Benn make an untenable leap to justify their vaccine-exposure hypothesis as relevant to policy by over-interpreting imprecise risk ratios (RR) from existing trials, evident by wide 95% confidence intervals (CIs) that should give pause about uncertainty.

For example, in a trial in Guinea-Bissau that the authors cite as providing evidence of decline in the impact of vitamin A on preschool child survival, there was a 9% reduction in mortality among 6–23-month-old children. While not significant (95% CI: -41% to 41%),⁵ the estimate remains compatible with a long-established 24%–34% reduction in preschool child mortality that has been estimated across different vitamin A interventions.^{6,7} Associated with this weak overall effect, there was a significant interaction by sex that revealed a clear reduction, and suggestive increase, in mortality among girls and boys, respectively. Despite a need for caution when interpreting subgroup effects and imprecise confidence intervals, the authors claim their results are strikingly different from previous trials.

Caution is similarly ignored in inferring that newborn vitamin A supplementation may increase infant mortality, especially in girls. Studies cited by Arts and Benn to support their claim all reported RRs of 0.90 to 1.12, with none having 95% CIs excluding 1.00.^{5,8–12} Some estimates were suggestive of a higher RR from vitamin A receipt in boys,^{5,11} another in girls,⁹ and some in neither sex,^{10,12} while all sex-specific 95% CIs except one (for girls in Guinea-Bissau⁹) included unity. At present, the most tenable explanation for variation in risk observed by sex across trials, given the evidence, is chance.

The above inference should not detract from Arts and Benn's pursuit of a vaccine-exposure hypothesis, but it should guide one's stand on policy. Newborn vitamin A trials in Southern Asia have all reported protective main effects (RRs) against infant mortality of

0.36 to 0.90, each with a 95% CI <1.00,^{12–15} while across Africa effects have ranged from 0.98 to 1.16, all with 95% CIs that include unity.^{8–11,16} Reasons for this “continental divide” may relate to regional differences in maternal vitamin A deficiency.¹⁷ Thus, a policy implication also consistent with existing evidence would be to supplement newborns with vitamin A in Southern Asia, averting >150,000 infant deaths annually,¹⁸ but not in Africa where, for reasons to be understood, it has, to date, shown no effect.

Correspondence: Keith P West, Jr.

George G Graham Professor of Infant and Child Nutrition, Center for Human Nutrition, Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA **Email:** kwest1@jhu.edu

References

- Palmer AC. Nutritionally mediated programming of the developing immune system. *Adv Nutr* 2011;2:377–95.
- Ross AC. Vitamin A and retinoic acid in T cell-related immunity. *Am J Clin Nutr* 2012;96:1166S–72S.
- Arts RJ, Blok BA, van Crevel R et al. Vitamin A induces inhibitory histone methylation modifications and down-regulates trained immunity in human monocytes. *J Leukoc Biol* 2015; 98:129–36.
- Palmer AC, Schulze KJ, Khatry SK et al. Maternal vitamin A supplementation increases natural antibody concentrations of preadolescent offspring in rural Nepal. *Nutrition* 2015;31:813–9.
- Fisker AB, Bale C, Rodrigues A et al. High-dose vitamin A with vaccination after 6 months of age: a randomized trial. *Pediatrics* 2014;134:e739–48.
- Beaton GH, Martorell R, L'Abbe KA et al. Effectiveness of vitamin A supplementation in the control of young child morbidity and mortality in developing countries. Final report of the Canadian International Development Agency. Toronto: University of Toronto, 1993.
- Fawzi WW, Chalmers TC, Herrera MG et al. Vitamin A supplementation and child mortality: a meta-analysis. *JAMA* 1993;269:898–903.
- Benn CS, Diness BR, Roth A et al. Effect of 50 000 IU vitamin A given with BCG vaccine on mortality in infants in Guinea-Bissau: randomised placebo controlled trial. *BMJ* 2008;336:1416–20.
- Benn CS, Fisker AB, Napirna BM et al. Vitamin A supplementation and BCG vaccination at birth in low birthweight neonates: two by two factorial randomised controlled trial. *BMJ* 2010;340:c1101.
- Masanja H, Smith ER, Muhihi A et al. Effect of neonatal vitamin A

supplementation on mortality in infants in Tanzania (Neovita): a randomised, double-blind, placebo-controlled trial. *Lancet* 2015;385:1324–32.

11. Edmond KM, Newton S, Shannon C et al. Effect of early neonatal vitamin A supplementation on mortality during infancy in Ghana (Neovita): a randomised, double-blind, placebo-controlled trial. *Lancet* 2015;385:1315–23.
12. Mazumder S, Taneja S, Bhatia K et al. Efficacy of early neonatal supplementation with vitamin A to reduce mortality in infancy in Haryana, India (Neovita): a randomised, double-blind, placebo-controlled trial. *Lancet* 2015;385:1333–42.
13. Humphrey JH, Agoestina T, Wu L et al. Impact of neonatal vitamin A supplementation on infant morbidity and mortality. *J Pediatr* 1996;128:489–96.
14. Rahmathullah L, Tielsch JM, Thulasiraj RD et al. Impact of supplementing newborn infants with vitamin A on early infant mortality: community based randomized trial in southern India. *BMJ* 2003;327:254–9.
15. Klemm RDW, Labrique AB, Christian P et al. Newborn vitamin A supplementation reduced infant mortality in rural Bangladesh. *Pediatrics* 2008;122:242–50.
16. Malaba LC, Illiff PJ, Nathoo KJ et al. Effect of postpartum maternal or neonatal vitamin A supplementation on infant mortality among infants born to HIV-negative mothers in Zimbabwe. *Am J Clin Nutr* 2005;81:454–60.
17. World Health Organization. Neonatal Vitamin A and Infant Mortality Working Group Meeting, Geneva: WHO, September 2014.
18. West KP Jr, Sommer A. Neonatal vitamin A: time to move on? [correspondence] *Lancet* 2015;386:131–2.

Vitamin A and Epigenetic Modifications

2. Observations by Charles B Stephensen

Charles B Stephensen

USDA-ARS Western Human Nutrition Research Center,
University of California, Davis, CA, USA

Cells of the immune system undergo epigenetic, transcriptional programming during normal development. Perhaps the best characterized example is the development of memory T-cells which develop both “inflammatory” phenotypes, such as Th1 cells that protect against infections including tuberculosis, and “regulatory” phenotypes, such as Treg cells, that dampen inflammation during the resolution phase of an immune response.¹

Interestingly, the vitamin A metabolite retinoic acid can enhance the development of either cell type depending on experimental conditions.² Looking at either effect in isolation might lead to a prediction that vitamin A supplementation would only promote or only dampen inflammation, while the actual effect is more complex. Innate immune cells such as monocytes and macrophages also undergo transcriptional programming.³ Retinoic acid again has apparently contradictory effects on these cells, both enhancing killing of tuberculosis bacilli by monocytes⁴ but also dampening the production of cytokines by monocytes transcriptionally programmed by BCG to produce high levels of cytokines upon activation.⁵

The vitamin D metabolite calcitriol has similar effects, enhancing killing of tuberculosis bacilli by macrophages⁶ but also programming a mechanism to dampen IL-6 production longer term.⁷ When vitamin D is used to treat tuberculosis as adjunct therapy it can, at least in some settings, both speed bacterial clearance and dampen inflammation,⁸ with both effects likely benefitting the patient.

In this issue Arts and Benn suggest that the ability of vitamin A to dampen BCG programming of monocytes to produce high levels of inflammatory cytokines will be a “negative” under circumstances where this programming may have non-specific protective effects for infants. This is an interesting and important hypothesis but, as the preceding examples show, making predictions from isolated *in-vitro* treatment effects for vitamin A is risky. It would be useful to test this prediction in an animal model to see if there is an *in vivo* correlate of the *in-vitro* observation. Even then, it is difficult to make concrete predictions for nutrients such as vitamin A and vitamin D, which have such varied effects on the immune system. Continuing to examine these questions will help us understand the mechanisms of action of these nutrients. Such advances in knowledge will help in the formulation of public health nutrition policies. It is important to re-evaluate such policies in the light of new research findings. This is particularly true of vitamin A at the moment, as such a re-evaluation is currently being discussed by the scientific community.^{9,10}

.....

Correspondence: *Charles B Stephensen,*
USDA-ARS Western Human Nutrition Research Center,
430 West Health Sciences Drive, University of California, Davis,
CA, USA Email: charles.stephensen@ars.usda.gov

.....

References

01. Janson PC, Winerdal ME, Winqvist O. At the crossroads of T helper lineage commitment – Epigenetics points the way. *Biochim Biophys Acta* 2009;1790:906–19.
02. Hall JA, Cannons JL, Grainger JR et al. Essential role for retinoic acid in the promotion of CD4(+) T cell effector responses via retinoic acid receptor alpha. *Immunity* 2011;34:435–47.
03. Schultze JL. Transcriptional programming of human macrophages: on the way to systems immunology. *J Mol Med (Berl)* 2015;93:589–97.
04. Wheelwright M, Kim EW, Inkeles MS et al. All-trans retinoic acid-triggered antimicrobial activity against *Mycobacterium tuberculosis* is dependent on NPC2. *J Immunol* 2014;192:2280–90.
05. Arts RJ, Blok BA, van Crevel R et al. Vitamin A induces inhibitory histone methylation modifications and down-regulates trained immunity in human monocytes. *J Leukoc Biol* 2015;98:129–36.
06. Liu PT, Stenger S, Li H et al. Toll-like receptor triggering of a vitamin D-mediated human antimicrobial response. *Science* 2006;311:1770–3.
07. Zhang Y, Leung DY, Goleva E. Vitamin D enhances glucocorticoid action in human monocytes: involvement of granulocyte-macrophage colony-stimulating factor and mediator complex subunit 14. *J Biol Chem* 2013;288:14544–53.
08. Coussens AK, Wilkinson RJ, Hanifa Y et al. Vitamin D accelerates resolution of inflammatory responses during tuberculosis treatment. *Proc Natl Acad Sci U S A* 2012;109:15449–54.
09. Mason J, Greiner T, Shrimpton R et al. Vitamin A policies need rethinking. *Int J Epidemiol* 2015;44:283–92.
10. West KP, Jr., Sommer A, Palmer A et al. Commentary: Vitamin A policies need rethinking. *Int J Epidemiol* 2015;44:292–4; discussion 4–6.

ADVERT

Micronutrient FORUM

Global Conference 2016

24-28 October
Cancun, Mexico

Experts in nutrition, health, agriculture, food security and business from around the globe will gather to share up-to-date evidence, program experiences and innovative ideas, in the quest to bring an end to micronutrient deficiencies.

Save the Date!

www.micronutrientforum.org

Conversion of Dietary Carotenoids and Vitamin A into Bioactive Retinoids: Exploring trails blazed by Jim Olson

James Allen Olson Memorial Lecture

Earl H Harrison

Ohio State University, Columbus, USA



James Allen Olson

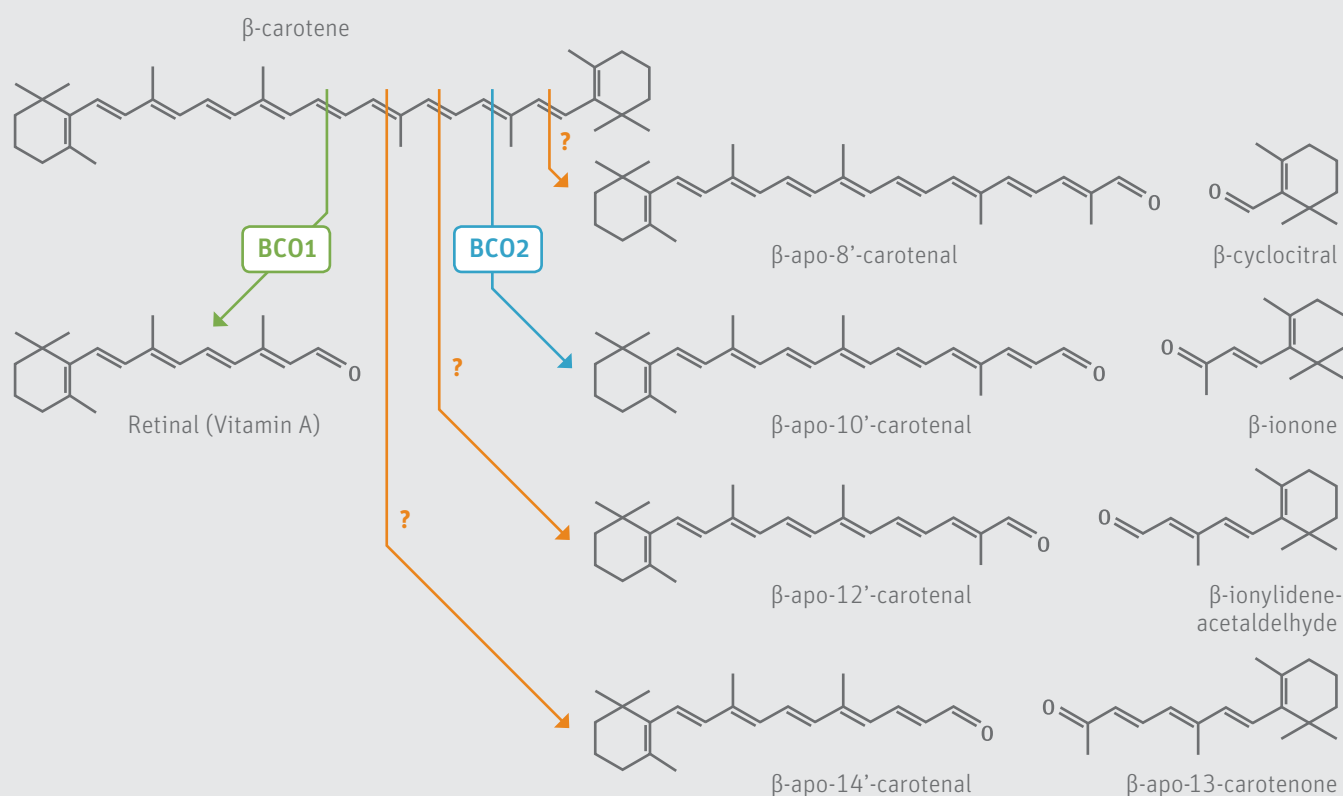
Vitamin A, carotenoids, and James Allen Olson

As readers of *Sight and Life* well know, vitamin A deficiency is one of the major micronutrient deficiencies worldwide and af-

fects millions of children and women in the developing world. The widespread morbidity and mortality associated with the deficiency reflects the fact that the active forms of vitamin A (retinoids) are critical signaling molecules necessary in higher vertebrates for embryonic development, the regulation of gene transcription, visual transduction, immune function, and the control of metabolic processes. In spite of their importance in vertebrate development and physiology, the capability for the biosynthesis of molecules with retinoid activities is restricted to plants and microorganisms. Thus, animals, including humans, must obtain the essential vitamin A from the diet. Vitamin A activity in the diet comes from two sources: preformed vitamin A as retinyl esters in foods of animal origin, and provitamin A carotenoids, such as β -carotene, α -carotene, and β -cryptoxanthin, found in plant-derived foods. Indeed, in areas of the world with vitamin A deficiency, the major source of vitamin A is dietary carotenoids.

While the chemical and nutritional relationships of provitamin A carotenoids and vitamin A were appreciated by the 1930s it was in the last half of the 20th century that great advances in our understanding of metabolism, function, and public health significance of carotenoids and vitamin A led us to our current state of knowledge in these fields. While these advances were the results of the efforts of many basic scientists, clinicians, and public health experts, James Allen Olson stands out as one of the giants in the fields of vitamin A and carotenoids. What is particularly noteworthy about his work was that it involved a remarkable balance of basic research *and* the application of that research to the practical problem of vitamin A deficiency in hu-

FIGURE 1: Enzymatic cleavage of β -carotene. Oxidative cleavage of β -carotene at the central 15,15' double bond is catalyzed by the enzyme β -carotene 15,15'-oxygenase 1 (BCO1) and leads to the generation of two molecules of retinal (β -apo-15-carotenal). Cleavage at the 9',10' double bond is catalyzed by β -carotene 9',10'-oxygenase 2 (BCO2) and yields β -apo-10'-carotenal and β -ionone. Eccentric cleavage at other double bonds may occur non-enzymatically or may be catalyzed by enzymes that are not yet fully characterized.



mans. In the latter area, his work on developing new ways to assess liver stores of vitamin A in humans continues to be critically important in determining the distribution and extent of vitamin A deficiency throughout the world.^{1,2}

“James Allen Olson stands out as one of the giants in the fields of vitamin A and carotenoids”

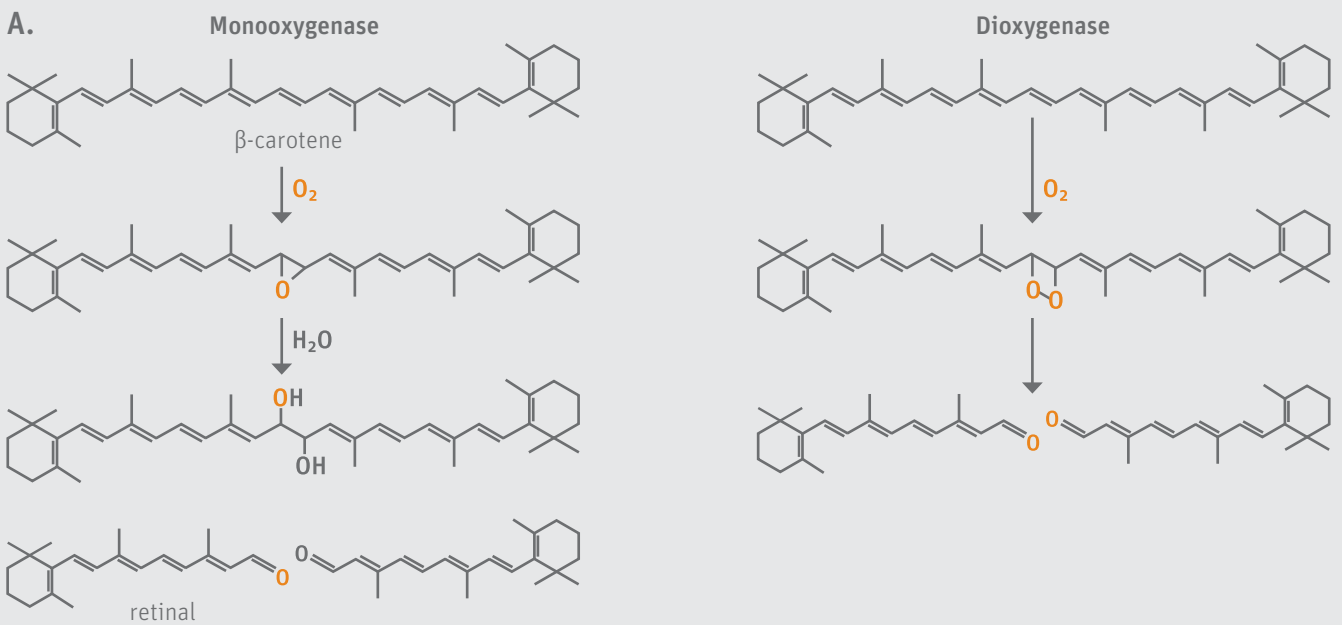
In addition to his important work on human vitamin A deficiency, Jim Olson always maintained an active research program that yielded important advances in understanding the basic biochemistry and metabolism of vitamin A. Indeed, his first publications after establishing his own laboratory focused on the enzymatic conversion of β -carotene to vitamin A.^{3,4,5,6} He also had a long-standing interest in the so-called “eccentric” cleavage of β -carotene to the β -apocarotenoids.^{7,8,9} This brief review

attempts to highlight the current state of knowledge in this area as developed by many investigators who have followed these trails blazed by Jim Olson.

Central vs. eccentric cleavage of β -carotene and the enzymes involved

In 1965, Olson (and independently Goodman) published the first *in-vitro* studies using extracts from rat liver and intestinal mucosa to demonstrate enzymatic oxidative cleavage of β -carotene at the central double bond to yield retinal.^{10,11} However, it would be 35 years before the enzyme was purified and characterized at the molecular level. In 2000, the enzyme responsible for the conversion of β -carotene to retinal was identified in *Drosophila*¹² and chicken,¹³ and was named β -carotene-15,15'-monooxygenase 1 (BCO1). BCO1 has also been identified in humans^{14,15,16} and mice,^{17,18} and subsequently in a number of other taxa. In 2001, another carotenoid cleavage enzyme that catalyzes eccentric cleavage, β -carotene-9',10'-oxygenase (BCO2), was identified in humans, mice and zebrafish by von Lintig and colleagues.¹⁹

FIGURE 2: BCO1 reaction mechanism study. Human BCO1 is a dioxygenase. **A.** The putative reaction mechanisms of BCO1: A monooxygenase incorporates an oxygen atom from O_2 in one retinal molecule, and an oxygen atom from water into the other. A dioxygenase incorporates only atoms from O_2 into the cleavage products. **B.** Theoretical percentages of ^{18}O -retinal that will be obtained for oxygen labeling experiments with BCO1 as a monooxygenase and as a dioxygenase. **C.** Summary of results of oxygen labeling experiments with purified recombinant BCO1. The numbers separated by commas are the % ^{18}O enrichment of the retinal product from individual experiments done on different days. Retinal obtained from the BCO1- β -carotene reaction contains predominantly the same oxygen isotope as O_2 . Control incubation of active BCO1 with ^{18}O -retinal in $H_2^{16}O$ and ^{16}O -retinal in $H_2^{18}O$ account for the oxygen exchange that occurred in the corresponding BCO1- β -carotene reactions. Thus, BCO1 incorporates solely oxygen from O_2 during the oxidative cleavage of β -carotene, and is therefore a dioxygenase.



Adapted from dela Sena et al.²²

B. Theoretical results

% ^{18}O -retinal			
$^{16}O_2$ - H_2 ^{18}O		$^{18}O_2$ - H_2 ^{16}O	
Monooxygenase	Dioxygenase	Monooxygenase	Dioxygenase
50	0	50	100

C. Experimental results

% ^{18}O -retinal	
$^{16}O_2$ - H_2 ^{18}O	$^{18}O_2$ - H_2 ^{16}O
BCO1 + β -carotene	BCO1 + β -carotene
3, 6, 10	79, 85
BCO1 + ^{16}O -retinal (>99% atom)	BCO1 + ^{18}O -retinal (91% atom)
5, 7, 13	67, 84

The study of carotenoid oxygenase enzymes is complicated by the fact that carotenoids are also prone to nonenzymatic oxidation during incubation, extraction and processing. Maret and Hansen incubated β -carotene under conditions similar to the early *in-vitro* studies of Goodman and Olson in the absence of enzyme, and detected eccentric cleavage products or β -apocarotenoids.²⁰ Intestinal homogenates were used in most of the early *in-vitro* studies of BCO1. However, the intestine also contains peroxidases that can potentially oxidize carotenoids.²⁰ **Figure 1** shows the cleavages of β -carotene catalyzed by BCO1, BCO2, and as yet undefined mechanisms.

BCO1 only reacts with carotenoids with at least one unmodified ionone ring and at least 30 carbons. Among these, β -carotene has been shown to be the best substrate for BCO1.^{14,21} The human enzyme also catalyzes cleavage of the β -apocarotenals to yield retinal.²²

BCO1 is a soluble (cytosolic) enzyme^{14,23} and exists as a monomer.^{24,25} *In vivo* it is expressed in a variety of tissues. Early experiments have shown high BCO1 activity in tissue homogenates from intestines,^{10,11,26} and it is no surprise that BCO1 expression is particularly high in intestine and liver.

Both Olson & Hayasi¹⁰ and Goodman & Huang¹¹ suggested that the central cleavage enzyme was a dioxygenase based on substrate and cofactor requirements, but did not rule out a monooxygenase mechanism. In 2001, shortly after purified enzyme was available, a monooxygenase mechanism was indeed proposed for BCO1 by Leuenberger et al.²⁷ In this study, α -carotene was incubated with purified chicken BCO1 and horse liver aldehyde dehydrogenase in an 85% $^{17}\text{O}_2$ -95% H_2^{18}O environment. The resulting products (retinol and α -retinol) were purified by HPLC and silylated. Using gas chromatography (GC)-MS, the authors found virtually equal enrichment of ^{17}O and ^{18}O in both silylated retinols, suggesting a monooxygenase mechanism for BCO1. However, it is possible that the long reaction time (7.5 hours) and extensive processing (reduction of the aldehydes, purification, silylation) favored oxygen exchange between the initial aldehyde products and the medium. We have recently re-investigated the reaction mechanism of human BCO1 using highly purified recombinant human enzyme, short reaction times and using both ^{18}O water and ^{18}O gas.²⁸ These new results described in **Figure 2** show clearly that the enzyme is a dioxygenase.

“The enzyme BCO1 is a dioxygenase”

The most obvious function of BCO1 is to generate retinal (vitamin A aldehyde) from dietary carotenoids. Indeed, BCO1 knockout mice tend to have high levels of stored carotenoids and low levels of retinol and retinyl esters.²⁹ A loss-of-function mutation in BCO1 has been identified in a patient with hyper-

carotenemia and hypovitaminosis A.²⁴ However, BCO1 knockout mice have been shown to develop liver steatosis, elevated free fatty acids and obesity, even on a vitamin A sufficient diet.^{29,30} This suggests a greater metabolic role for BCO1 than just generating retinal from provitamin A carotenoids.

Unlike BCO1, BCO2 is able to catalyze the oxidative cleavage of xanthophylls such as zeaxanthin and lutein.^{31,32} The kinetic parameters obtained by Mein and colleagues also suggest that zeaxanthin and lutein are better substrates than β -cryptoxanthin. Kinetic data for different carotenoids with BCO2 are lacking, but the limited information available suggests that BCO2 has broader substrate specificity with respect to substrate molecule shape. In contrast to BCO1, BCO2 is a mitochondrial enzyme, and has been suggested to function primarily in preventing oxidative stress due to carotenoid accumulation by breaking down excess carotenoids.^{23,31} There are also differences in expression among tissues which suggest that BCO2 may play roles that are quite distinct from those of BCO1.

BCO1 knockout mice have elevated expression of BCO2, and vice versa.^{33,34} Upon β -carotene supplementation, BCO1 knockout mice accumulate β -apo-10'-carotenol, the alcohol form of the β -carotene-BCO2 cleavage product.³⁰ BCO1 knockout mice accumulate 3,3'-didehydrozeaxanthin and 3-dehydrolutein upon supplementation with zeaxanthin and lutein, respectively.³¹ This is consistent with the findings of other groups that these xanthophylls are not substrates for BCO1.

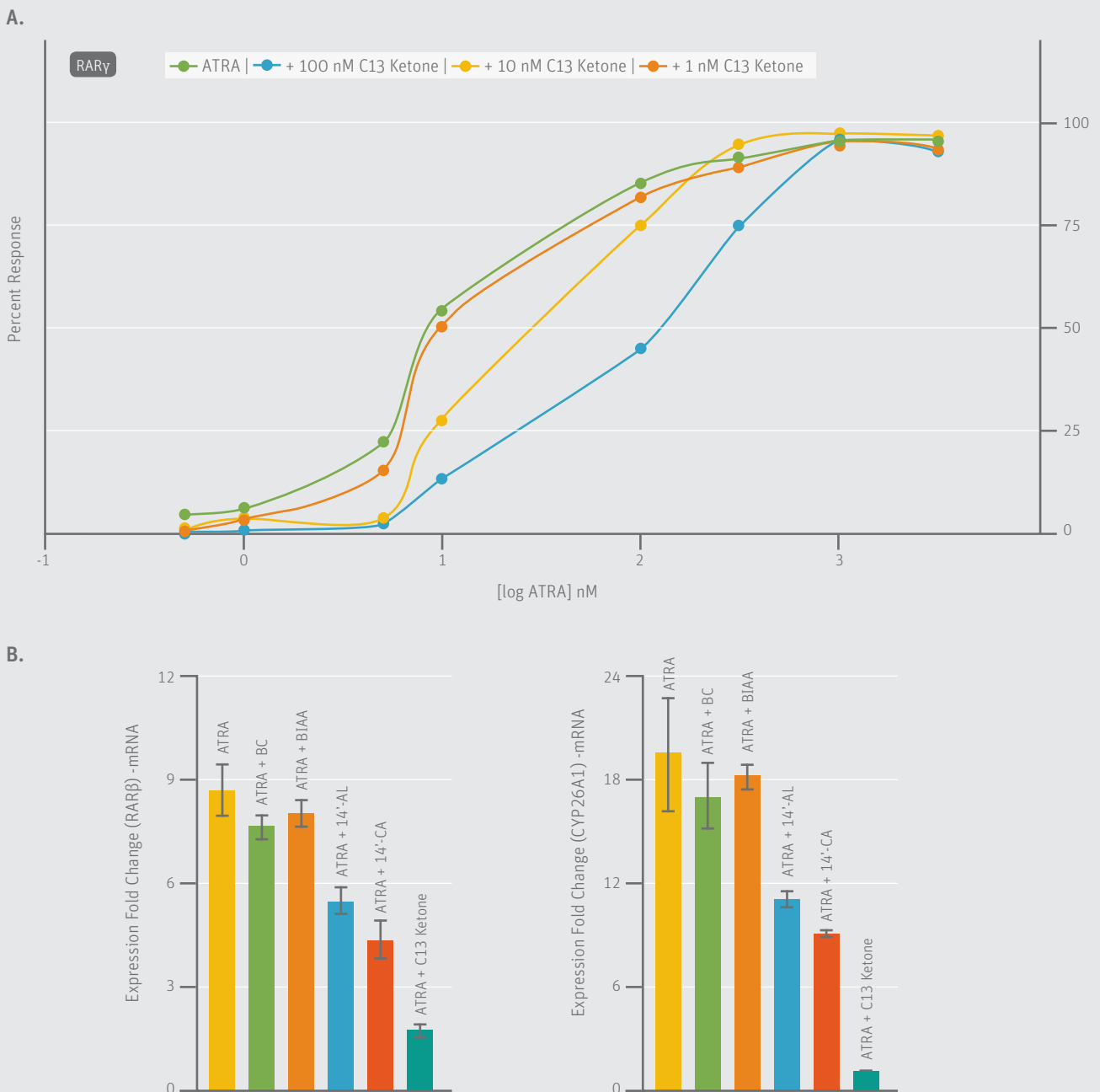
Occurrence, metabolism, and function of β -apocarotenoids in vertebrates

β -apocarotenoids are found endogenously in both natural foods³⁵ and diets prepared for experimental animals with β -carotene beadlets.³⁶ Thus, it is likely that these compounds can be absorbed in the intestine directly from the diet, but there are no studies on this point.

Additionally, β -apocarotenoids can arise in humans and rats from β -carotene metabolism. In one study, β -apo-8'-carotenol was detected in the plasma of a healthy man three days following ingestion of a small oral tracer dose of [^{14}C]- β -carotene.³⁷ Our group has conducted studies in which the concentrations of β -carotene, β -apo-8'-, 10'-, 12'- and 14'-carotenol and β -apo-13-carotenone were measured in serum and tissues (liver and heart) of wild type and BCO1 knockout mice that were on a β -carotene-containing diet.^{36,38} In general, these compounds are found in serum and tissues at nanomolar concentrations. The levels of β -apo-13-carotenone have been measured in human plasma by liquid chromatography (LC)-MS and found to be 3–5 nM.³⁹

The possible activation or inhibition of nuclear receptors, including retinoic acid receptors (RARs) and retinoid X receptors (RXRs), by β -apocarotenals has been studied by several groups. In general, the β -apocarotenoids are only very weak

FIGURE 3: β -apo-13-carotenone is a potent antagonist of retinoic acid receptor-mediated induction of reporter gene expression and blocks all-*trans* retinoic acid (ATRA) induction of endogenous gene expression. A. Dose response curves for transactivation of RAR γ (upper panel) by ATRA in the absence (green) or presence of 1 nm (orange), 10 nm (yellow), or 100 nm (blue) β -apo-13-carotenone (C13 ketone). **B.** Induction of expression of mRNAs for RAR β (left lower panel) or cytochrome P450, 26A1 (CYP26A1) (right lower panel) by 10 nm ATRA treatment alone or by co-treatment with ATRA and the test compounds at 10 nm, including β -carotene (BC), β -ionylideneacetic acid (BIAA), β -apo-14'-carotenal (14'-AL), β -apo-14'-carotenoic acid (14'-CA), and β -apo-13-carotenone (C13 ketone). mRNA levels were quantified by RT-PCR and are shown as the fold induction compared with vehicle-treated cells (n = 3); mean \pm SD.



agonists. However, there is accumulating evidence that some of the β -apocarotenoids are retinoid receptor antagonists. Thus, Ziouzenkova et al⁴⁰ describe RXR α activation in the presence of a synthetic agonist of RXR and β -apo-8', 12'- and 14'- carotenals in human bovine cells. Only β -apo-14'-carotenal effectively inhibited agonist-induced RXR α activation with an inhibition constant (Ki) of 500 nM. In addition, RXR partner nuclear receptors were tested including PPAR α , PPAR β/δ , and PPAR γ . It was found that β -apo-14'-carotenal decreased agonist-induced PPAR α and PPAR γ activation very effectively, and PPAR β/δ modestly. Most of the experiments in this study were conducted with 1–10 μ M β -apo-14'-carotenal.

The possibility that the β -apocarotenoids might function as antagonists rather than agonists of nuclear receptors has been supported by the results of recent studies in the author's laboratory, some of which have been previously reviewed in *Sight and Life* magazine.⁴¹ In one study, we investigated the effects of β -apocarotenoids on RXR α signaling.⁴² Transactivation assays were performed to test whether β -apocarotenoids activate or antagonize RXR α . None of the β -apocarotenoids tested activated RXR α . Among the compounds tested, β -apo-13-carotenone was found to antagonize the activation of RXR α by 9-*cis*-RA and was effective at concentrations as low as 1 nM. β -Apo-14'-carotenal and β -apo-14'-carotenoic acid were also found to be antagonists of RXR α , but with less potency than β -apo-13-carotenone. Molecular modeling studies revealed that β -apo-13-carotenone makes molecular interactions like an antagonist of RXR α .

In another study,³⁹ we found that β -apo-14'-carotenal, β -apo-14'-carotenoic acid, and β -apo-13-carotenone antagonized retinoic acid induced transactivation of all three of the retinoic acid receptors (RARs) and were effective at nanomolar concentrations. These compounds compete directly with retinoic acid for high affinity binding to purified receptors. The binding affinity for β -apo-13-carotenone is 4–5 nM, close to that of retinoic acid itself, while that of β -apo-14'-carotenal and β -apo-14'-carotenoic acid is 5–10 times lower. Molecular modeling studies confirmed that β -apo-13-carotenone can directly interact with the ligand binding site of the retinoid receptors. As shown in **Figure 3** β -apo-13-carotenone and the β -apo-14'-carotenoids inhibited both RAR γ -mediated reporter gene activity and retinoic acid-induced expression of retinoid responsive genes in HepG2 cells. These findings have important implications, as they suggest that β -apocarotenoids may function as naturally occurring retinoid antagonists.

.....
“ β -Apocarotenoids may function as naturally occurring retinoid antagonists”

Concluding remarks

The enzymatic conversion of dietary β -carotene to biologically active forms of vitamin A has been studied since the early 20th century. Starting with the pioneering work of Jim Olson and DeWitt Goodman in 1965, we now appreciate that the major pathway for the conversion of dietary β -carotene to vitamin A involves BCO1. The enzyme catalyzes the central cleavage of provitamin A carotenoids at the 15,15' double bond to yield two molecules of retinal (vitamin A aldehyde). It also cleaves each of the β -apo-carotenals (viz. β -apo-8', -10', -12', and -14'-carotenal) to generate retinal directly. This explains the vitamin A activity observed on feeding these β -apocarotenals. The enzyme functions as a dioxygenase, as speculated early on by both Olson and Goodman, but this mechanism was only recently rigorously established.

Although work on the basic enzymology of BCO1 may seem esoteric, understanding the structure, mechanism, and substrate specificity of the enzyme actually has relevance to public health. Thus, it is now appreciated that various SNPs (single nucleotide polymorphisms) in the BCO1 gene lead to different efficiencies in the conversion of provitamin A carotenoids to vitamin A. Indeed, genetic variation in the enzyme may partly explain the differences among humans in the efficiency with which they can convert provitamin A carotenoids to vitamin A and thus their susceptibility to vitamin A deficiency.

.....
“Understanding BCO1 has relevance to public health”

We now also have a much fuller appreciation of the pathways of eccentric cleavage of β -carotene to the other β -apocarotenals (other than retinal) than when Olson and others tackled this problem in the last half of the 20th century. The seminal work of Johannes von Lintig and colleagues in identifying and characterizing BCO2 has led to a much greater, but more complex, picture of the role of metabolites of dietary carotenoids in metabolism and physiology. Thus it is now clear that, while BCO2 is not a major player in the generation of vitamin A, the enzyme plays important roles in the metabolism of non-provitamin-A carotenoids, such as the xanthophylls, lutein and zeaxanthin. It also appears to play even wider roles in lipid metabolism and mitochondrial function.

Finally, the demonstration of the occurrence of β -apocarotenoids in the diet and the fact that some of these metabolites have potent biological activities on their own leads us to a greater appreciation of the richness and complexity of the many roles that dietary carotenoids play in human health and disease. Jim Olson would be very pleased, because he always knew this.

Acknowledgments

I sincerely thank the many students, fellows, colleagues, and collaborators who have contributed to the studies in our laboratory. I also gratefully acknowledge the financial support of the National Institutes of Health (NIDDK and NHLBI) and the US Department of Agriculture.

Correspondence: Earl H Harrison,

Department of Human Sciences, Ohio State University,
1787 Neil Avenue, Columbus, OH 43210, USA

E-mail: harrison.304@osu.edu

References

01. Tanumihardjo SA, Furr HC, Erdman JW Jr et al. Use of the modified relative dose response (MRDR) assay in rats and its application to humans for the measurement of vitamin A status. *Eur J Clin Nutr* 1990;44(3):219–24.
02. Olson JA. Isotope-dilution techniques: a wave of the future in human nutrition. *Am J Clin Nutr* 1997;66(1):186–7.
03. Olson JA. A requirement for sodium glycocholate in the intestinal conversion of beta-carotene to vitamin A *in vivo* and *in vitro*. *Biochim Biophys Acta* 1960;37:166–7.
04. Olson JA. The conversion of radioactive beta-carotene into vitamin A by the rat intestine *in vivo*. *J Biol Chem* 1961;236:349–56.
05. Olson, JA. The absorption of beta-carotene and its conversion into vitamin A. *Am J Clin Nutr* 1961;9(4)Pt 2:1–12.
06. Zachman RD, Olson JA. The uptake of C14-beta-carotene and its conversion to retinol ester (vitamin A ester) by the isolated perfused rat liver. *J Biol Chem*. 1963 238:541–6.
07. Zeng S, Furr HC, Olson JA. Human metabolism of carotenoid analogs and apocarotenoids. *Methods Enzymol* 1993;214:137–47.
08. Nagao A, During A, Hoshino C et al. Stoichiometric conversion of all-*trans*-beta-carotene to retinal by pig intestinal extract. *Arch Biochem Biophys* 1996;328(1):57–63.
09. Barua AB, Olson JA. beta-Carotene is converted primarily to retinoids in rats *in vivo*. *J Nutr* 2000;130(8):1996–2001.
10. Olson JA, Hayaishi O. The enzymatic cleavage of beta-carotene into vitamin A by soluble enzymes of rat liver and intestine. *Proc Natl Acad Sci USA* 1965;54(5):1364–70.
11. Goodman DS, Huang HS. Biosynthesis of Vitamin A with Rat Intestinal Enzymes. *Science* 1965;149:879–80.
12. von Lintig J, Vogt K. Filling the gap in vitamin A research. Molecular identification of an enzyme cleaving β -carotene to retinal. *J Biol Chem* 2000;275:11915–20.
13. Wyss A, Wirtz G, Woggon W et al. Cloning and expression of β , β -carotene 15,15'-dioxygenase. *Biochem Biophys Res Commun* 2000;271:334–6.
14. Lindqvist A, Andersson S. Biochemical properties of purified recombinant human β -carotene 15,15'-monooxygenase. *J Biol Chem* 2002;277:23942–8.
15. Lindqvist A, Andersson S. Cell type-specific expression of β -carotene 15,15'-mono-oxygenase in human tissues. *J Histochem Cytochem* 2004;52:491–9.
16. Yan W, Jang GF, Haeseleer F et al. Cloning and characterization of a human β , β -carotene-15,15'-dioxygenase that is highly expressed in the retinal pigment epithelium. *Genomics* 2001;72:193–202.
17. Paik J, During A, Harrison EH et al. Expression and characterization of a murine enzyme able to cleave β -carotene. The formation of retinoids. *J Biol Chem* 2001;276:32160–8.
18. Redmond TM, Gentleman S, Duncan T et al. Identification, expression, and substrate specificity of a mammalian β -carotene 15,15'-dioxygenase. *J Biol Chem* 2001;276:6560–5.
19. Kiefer C, Hessel S, Lampert JM et al. Identification and characterization of a mammalian enzyme catalyzing the asymmetric oxidative cleavage of provitamin A. *J Biol Chem* 2001;276:14110–6.
20. Hansen S, Maret W. Retinal is not formed *in vitro* by enzymatic central cleavage of β -carotene. *Biochemistry* 1988;27:200–6.
21. Kim YS, Oh DK. Substrate specificity of a recombinant chicken β -carotene 15,15'-monooxygenase that converts β -carotene into retinal. *Biotechnol Lett* 2009;31:403–8.
22. dela Sena C, Narayanasamy S, Riedl KM et al. Substrate specificity of purified recombinant human beta-carotene 15,15'-oxygenase (BCO1). *J Biol Chem* 2013;288(52):37094–103.
23. Raghuvanshi S, Reed V, Blaner WS et al. Cellular localization of β -carotene 15,15' oxygenase-1 (BCO1) and β -carotene 9',10' oxygenase-2 (BCO2) in rat liver and intestine. *Arch Biochem Biophys* 2015 Jan 6. doi: 10.1016/j.abb.2014.12.024. [Epub ahead of print]
24. Lindqvist A, Sharvill J, Sharvill DE et al. Loss-of-function mutation in carotenoid 15,15'-monooxygenase identified in a patient with hypercarotenemia and hypovitaminosis A. *J Nutr* 2007;137:2346–50.
25. Kowitz T, Babino D, Kiser P et al. Characterization of human β , β -carotene-15,15'-monooxygenase (BCMO1) as a soluble monomeric enzyme. *Arch Biochem Biophys* 2013;539:214–22.
26. Lakshmanan MR, Chansang H, Olson JA. Purification and properties of carotene 15,15'-dioxygenase of rabbit intestine. *J Lipid Res* 1972;13:477–82.
27. Leuenberger MG, Engeloch-Jarret C, Woggon WD. The reaction mechanism of the enzyme-catalyzed central cleavage of β -carotene to retinal. *Angew Chem Int Ed Engl* 2001;40:2613–2617.
28. dela Sena C, Narayanasamy S, Riedl KM et al. The human enzyme that converts dietary provitamin A carotenoids to vitamin A is a dioxygenase. *J Biol Chem* 2014;289:13661–13666.
29. Hessel S, Eichinger A, Isken A et al. CMO1 deficiency abolishes vitamin A production from β -carotene and alters lipid metabolism in mice. *J Biol Chem* 2007;282:33553–61.
30. Amengual J, Gouranton E, van Helden YG et al. β -Carotene reduces body adiposity of mice via BCMO1. *PLoS One* 2011; 6:e20644.

31. Amengual J, Lobo GP, Golczak M et al. A mitochondrial enzyme degrades carotenoids and protects against oxidative stress. *FASEB J* 2011;25:948–59.
32. Mein JR, Dolnikowski GG, Ernst H et al. Enzymatic formation of apo-carotenoids from the xanthophyll carotenoids lutein, zeaxanthin and beta-cryptoxanthin by ferret carotene-9',10'-monoxygenase. *Arch Biochem Biophys* 2011;506:109–21.
33. Maeda T, Perusek L, Amengual J et al. Dietary 9-cis- β , β -carotene fails to rescue vision in mouse models of leber congenital amaurosis. *Mol Pharmacol* 2011;80:943–52.
34. Ford NA, Moran NE, Smith JW et al. An interaction between carotene-15,15'-monoxygenase expression and consumption of a tomato or lycopene-containing diet impacts serum and testicular testosterone. *Int J Cancer* 2012;131:E143–8.
35. Fleshman MK, Lester GE, Riedl KM et al. Carotene and novel apocarotenoid concentrations in orange-fleshed Cucumis melo melons: determinations of β -carotene bioaccessibility and bioavailability. *J Agric Food Chem* 2011;59:4448–54.
36. Shmarakov I, Fleshman MK, D'Ambrosio DN et al. Hepatic stellate cells are an important cellular site for β -carotene conversion to retinoid. *Arch Biochem Biophys* 2010;504:3–10.
37. Ho CC, de Moura FF, Kim SH et al. Excentral cleavage of β -carotene *in vivo* in a healthy man. *Am J Clin Nutr* 2007;85:770–7.
38. Lee S-A, Jiang H, Trent CM et al. Cardiac dysfunction in β -carotene-15,15'-dioxygenase-deficient mice is associated with altered retinoid and lipid metabolism. *Am J Physiol Heart Circ Physiol* 2014;307:H1675–H1684.
39. Eroglu A, Hruszkewycz DP, dela Sena C et al. Naturally-occurring eccentric cleavage products of provitamin A β -carotene function as antagonists of retinoic acid receptors. *J Biol Chem* 2012;287:15886–95.
40. Ziouzenkova O, Orasanu G, Sukhova G et al. Asymmetric cleavage of β -carotene yields a transcriptional repressor of retinoid X receptor and peroxisome proliferator-activated receptor responses. *Mol Endocrinol* 2007;21:77–88.
41. Wang CX, Wongsiriroj N, Deckelbaum RJ et al. New findings on apo-carotenoid metabolites of β -carotene: Scientific and public health implications for the future. *Sight and Life* 2012;26(3):18–27.
42. Eroglu A, Hruszkewycz DP, Curley RW Jr et al. The eccentric cleavage product of β -carotene, β -apo-13-carotenone, functions as an antagonist of RXRa. *Arch Biochem Biophys* 2010;504:11–6.

The Challenges of Scaling Up Multiple Micronutrient Interventions

Stanley Zlotkin

Centre for Global Child Health,
The Hospital for Sick Children Toronto,
Canada and The Department of Paediatrics,
The Department of Nutritional Sciences and
The Dalla Lana School of Public Health,
University of Toronto, Toronto, Canada

Nandita Perumal

Centre for Global Child Health, The Hospital for
Sick Children, Toronto, Canada and Dalla Lana School
of Public Health, The University of Toronto,
Toronto, Canada

Carmen Ho,

Joseph Wong

Department of Political Science,
The University of Toronto, Toronto, Canada

With eight hundred million still living in extreme poverty and hunger, the Millennium Development Goals (MDGs) were created with a vision of a world with less poverty, hunger and disease; improved survival prospects for mothers and children; greater primary education; equal opportunities and empowerment for women; and a healthier environment.¹ While several countries have progressed towards achieving the MDGs, many interventions have nonetheless failed to improve the quality of life in a large number of the world's countries (Figure 1).² To be sure, despite enormous in-country and international efforts to achieve the first MDG of ending extreme poverty and hunger, an estimated 800 million people still face these challenges daily.³ One in seven children under the age of five years is still underweight (i.e., they weigh less than 2 standard deviations of the population average for their age and sex), and one in four children worldwide, or approximately 161 million children, are still stunted (i.e., they are below 2 standard deviations in height for age and sex).³

The crucial importance of evidence-based interventions

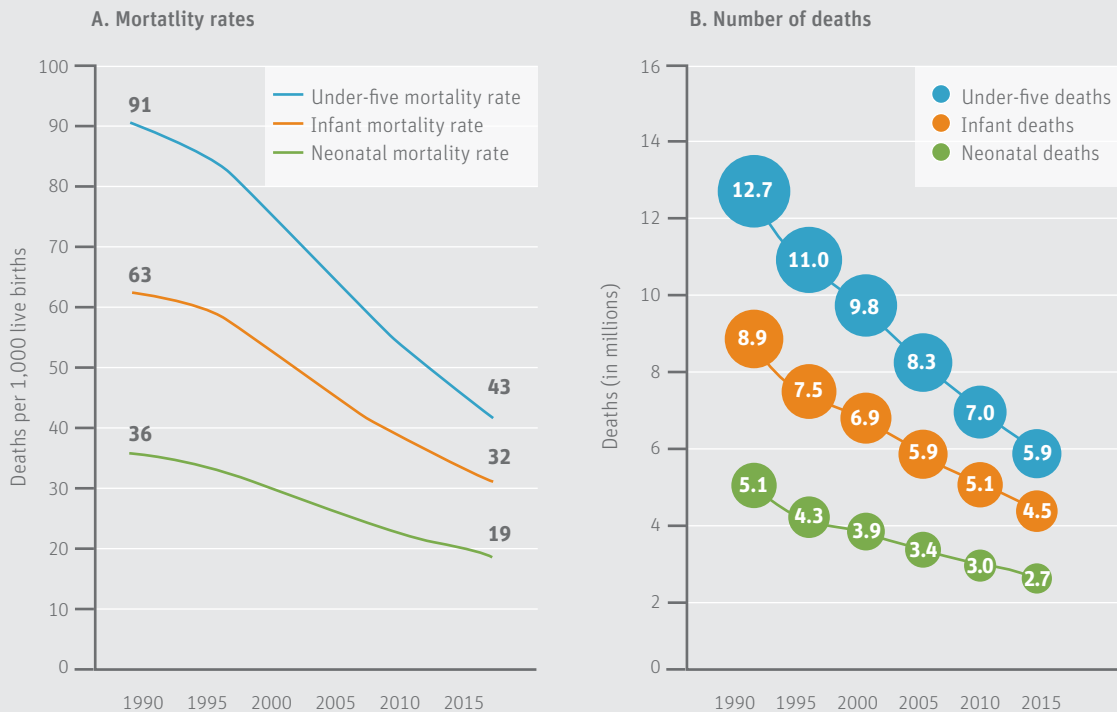
The implementation of evidence-based interventions is recognized by the international global public health and nutrition community as being essential to meet and surpass the MDGs. Of the 17 new Sustainable Development Goals (SDGs),⁴ two goals specifically address nutrition and implementation:

Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Goal 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

Of the 169 targets outlined within the 17 SDGs, Goals 2 and 17 include the following targets specifically associated with nutrition and implementation (*italics inserted*):

- 2.1:** By 2030, *end hunger* and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
- 2.2:** By 2030, *end all forms of malnutrition*, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.
- 17.9:** Enhance international support for *implementing* effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation.
- 17.16:** Enhance the Global Partnership for Sustainable Development, complemented by *multi-stakeholder partnerships* that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries.

FIGURE 1: Global under-five, infant and neonatal mortality rates and number of deaths, 1990–2015.

Source: United National Children's Fund (UNICEF), 2015² (with permission)

17.17: Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.

“We define scaling up as the intentional process of taking an intervention that has been successful in one context, and expanding or replicating the relevant policies, programs, or projects to other locations so that the intervention can benefit more people in an equitable and sustainable way”

Scaling up MNP interventions

The focus of the international global public health nutrition community to mitigate the burden of micronutrient deficiencies or “hidden hunger” among children under the age of 5 years is in

line with the SDG targets to end hunger and malnutrition. The process of scaling up (for MNPs or other interventions), however, is the final component of a four-stage process that includes research and discovery; setting up a supply (value) chain; developing business models for implementation; and, finally scaling up (Figure 2). We focus here on conceptualizing and framing processes for scaling up health interventions, and specifically on scaling up MNPs.

We define scaling up as the intentional process of taking an intervention that has been successful in one context, and expanding or replicating the relevant policies, programs, or projects to other locations so that the intervention can benefit more people in an equitable and sustainable way. Our focus on equitable scaling up draws attention to the needs of vulnerable and underserved populations, which tend to be the hardest to reach.⁵ While the notion of bringing-to-scale implies a reasonably straightforward process of expanding the reach of a local intervention, successfully scaling is in fact a complex social, political, and institutional process.⁶ Few pilot projects include the necessary components to maximize their prospects for scaling up, and among those that do seek to scale up, there is a poor record of local pilot projects extending their reach in any significant way.⁷ As a result, many successful interventions in health, employment, empowerment and socioeconomic development

remain confined to their original target areas; they are meeting local needs, but with little impact beyond.

Despite the rapid expansion of academic and practitioner literature on the subject and the obvious importance of scaling up in development work, the consensus on how best to transform local interventions into global solutions is just beginning to build. At least two reviews published recently summarize evidence from theoretical frameworks of scaling up health interventions.^{8,9} There is clearly a continued need for improved knowledge about best practices regarding the varied processes of how decision-makers prioritize, design and ultimately implement scaling-up strategies.

We have previously published an article on this topic in the Stanford Social Innovation Review.¹⁰ This article offers a summary of a practical framework to guide the processes of expanding relevant policies, programs and projects in order that successful local development interventions can benefit more people and have a larger impact.

Two approaches to scaling up

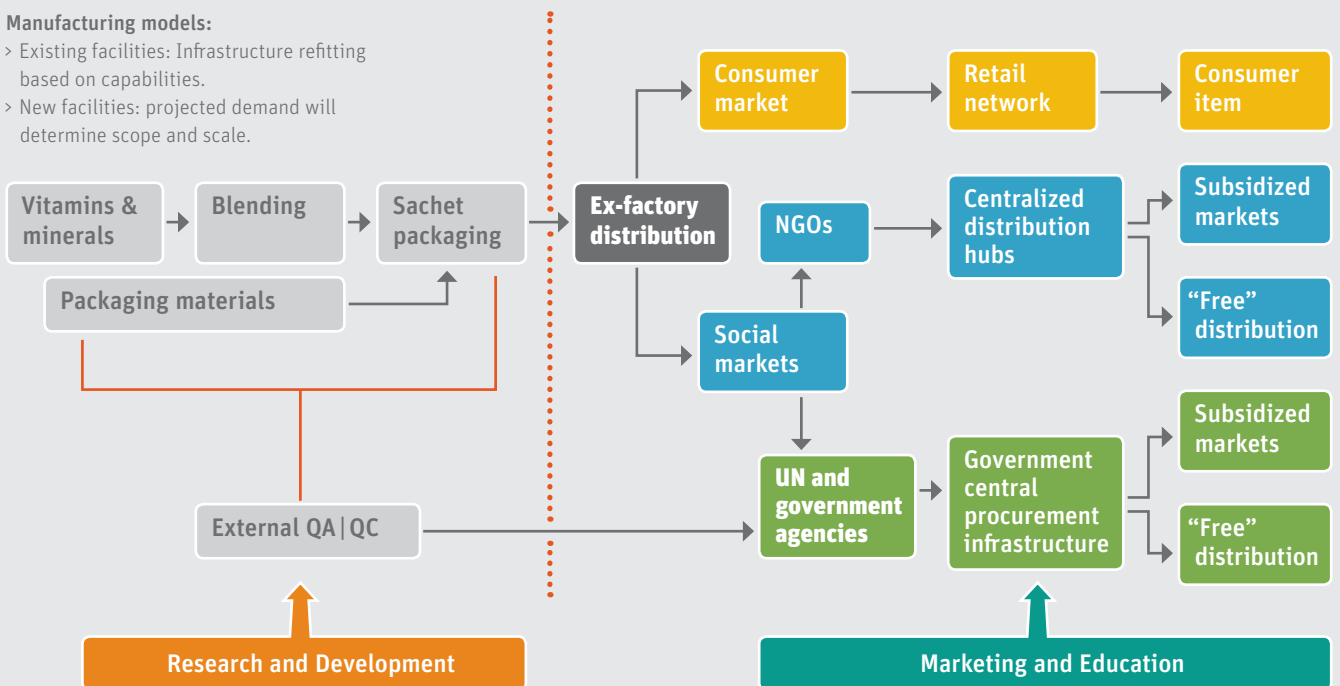
There are, we believe, two ways to think about sustainable national and multi-country scaling: **1)** scaling by replication; and **2)** scaling by custom design. Scaling by replication involves a process by which local solutions (products, programs, or poli-

cies) are exported and implemented elsewhere, with little or no concern about variations in local contexts and the specific end-users. This kind of “one-size-fits-all” approach presumes a universal logic in implementation: what works in one place should work in another. It assumes that good ideas, from a supply-side and functional point of view, should obliterate contextual variation. Unfortunately, with a few exceptions, scaling by replication alone does not work.

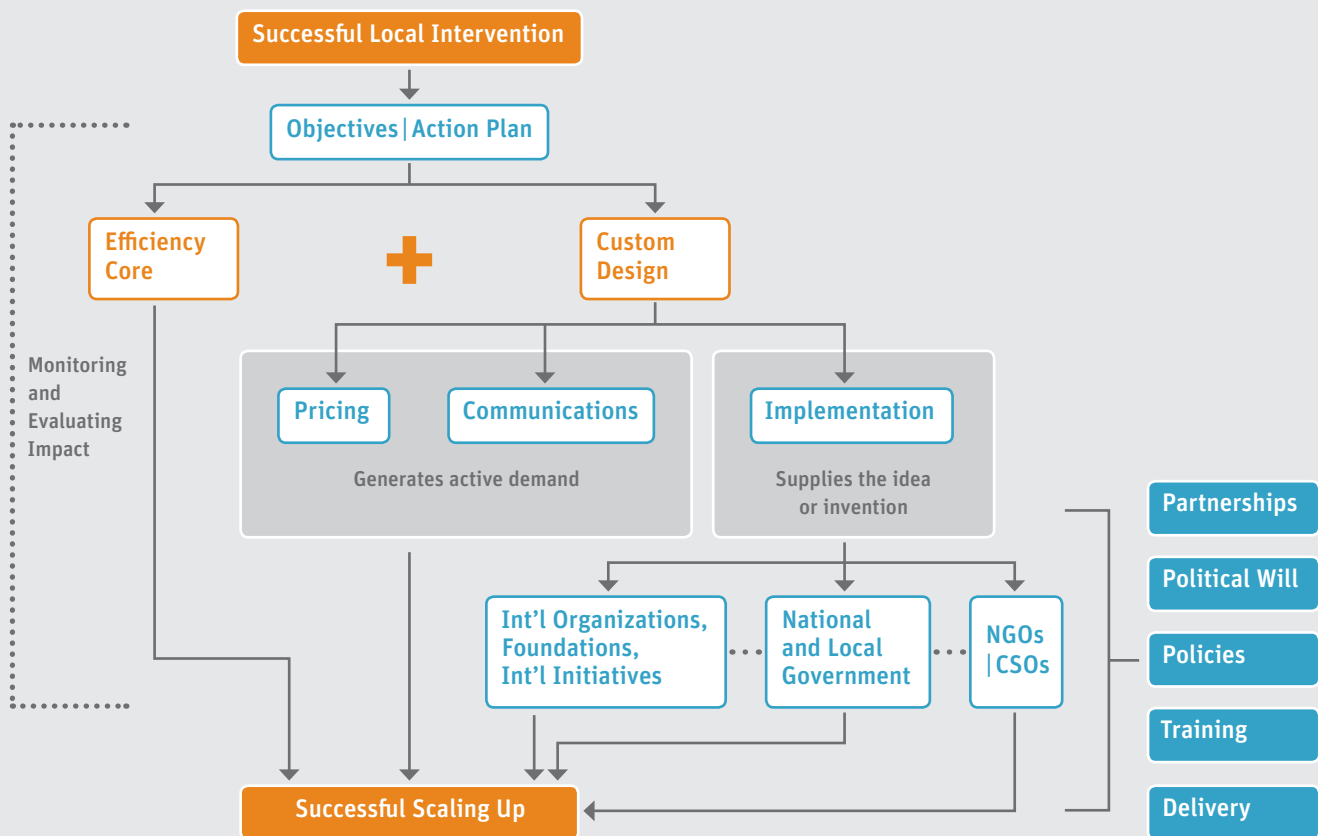
.....
“We propose a compromise between replication and custom design”

In scaling by custom design, local variables and local context are paramount. Solutions are custom designed to fit specific local contexts, shaped by costs, cultures, norms and existing practices. This approach is intuitively appealing, but rarely generates the efficiencies and economies of scale critical in the broader scaling-up process. We propose a middle-ground approach: one that describes a compromise between replication and custom design. At the center of our approach to scaling up is the assertion that one must come up with this compromise

FIGURE 2: Research and design stages for Sprinkles multiple micronutrient powders (MNPs).



Source: Sprinkles Global Health Initiative

FIGURE 3: Framework for scaling up interventions.

between custom design and pure replication by identifying and adapting what we are calling the *replicable efficiency core* of a proven solution (Figure 3). The *efficiency core* is a specific part, rather than the entire solution, which can be replicated with minimal modification to fit many varied local contexts.

The efficiency core of MNPs

The efficiency core of micronutrient powders, independent of the local context, is defined by the mixture of vitamins and minerals in a tasteless powder form available in a single-serve package format that, when added to any complementary foods, does not appreciably change the taste or color of the food. In addition to their ease of use, factors that contribute to the efficiency core of MNPs include: that they are food-based rather than a medicinal product; that they can be used in populations with low literacy; that they do not conflict with breast-feeding practices; and that they can be used to promote the timely introduction of complementary foods at 6 months of age, along with appropriate complementary feeding practices. Furthermore, MNPs are lightweight, inexpensive, easy to transport and store, and require limited technology to manufacture. These factors do not change, irrespective of where the product

is used, and thus they are defined as the replicable efficiency core. As suggested by Yamey et al,¹¹ MNPs meet the criteria of an intervention that is simple and has scientifically robust technical policies, necessary for scale.

We cannot presume, however, that a strong efficiency core for MNPs or any social solutions – be they in health, productivity, employment generation, empowerment and so on – will necessarily lead to adoption of those solutions by all end-users in all jurisdictions. Thus, where necessary, this efficiency core may be expanded or modified with an effective *custom design* to expressly fit specific local contexts to generate active adoption of the intervention (Figure 3). In the case of MNPs, examples of custom design include: using local language and appropriate artwork on the package; adapting the specific ingredients to meet local needs (e.g., vitamin D included in Mongolian MNPs because of high prevalence of vitamin D deficiency rickets);¹² and social marketing strategies appropriate for the local context.

In other words, scaling up requires, on the one hand, the replication of the intervention's efficiency core (Figure 4), and on the other, the adaptation of that efficiency core (i.e., customization of local implementation strategies) to ensure the replicable

FIGURE 4: What is the Efficiency Core for MNPs?

- > Easy to use and high acceptability among families and children; focus on ages 6–24 months
- > A food-based rather than a medical approach
- > Does not require literacy
- > Does not conflict with breastfeeding practices
- > Used to promote the timely introduction of complementary foods at 6 months of age and proper weaning practices
- > Can be used for other ages throughout the life cycle
- > Light weight, easy to store and transport
- > Inexpensive and low tech to manufacture



efficiency core is adopted and that active demand is generated. Active demand can be generated by identifying and executing **1)** an appropriate communications plan, and **2)** a pricing strategy – a communication strategy that clearly conveys the value and credibility of an intervention or program, its observable benefits, relevance, relative advantage, and viability, in conjunction with an appropriate price that is low enough to be affordable to the targeted group, but high enough to signal intrinsic value to the user, thus generating active demand. For example, recent studies have shown that charging a nominal fee (versus charging no fee) resulted in an increased use of bed-nets.¹³ In Mongolia, locally adapted social marketing strategies were used to promote the use of MNPs.¹²

“Scaling up requires the replication of the intervention’s efficiency core plus the adaptation of that efficiency core”

An effective implementation strategy

Generation of active demand for an intervention or program, however, must be supported by an implementation strategy that takes into consideration potential partnerships, the strength of political will, supportive public policies, training opportunities, and delivery options that are specific to a given context. Effective implementation strategy requires systematic planning from the outset (i.e., at the time of pilot intervention) so that “local”

implementation is in line with the objectives of scaling up and conducive to a sustainable strategy. Special attention has to be paid to ensure interventions and programs reach the most vulnerable and underserved populations.¹⁴

Partnerships are essential to implementing any intervention or program at scale. Sharing common interests, clearly defined organizational roles, and open communication can accelerate collaborations between international, national, and local actors. For example, the United Nations agencies, in collaboration with national and/or local governments, or with international non-governmental organizations (INGOs) and civil society organizations (CSOs), have implemented MNPs at scale in many contexts and contributed to the successful national distribution of MNPs in a number of jurisdictions. The political will of an organization or a person (“champion”) – which we define as the desire to scale up the intervention – is critical to ensure that an intervention or program is scaled up. Scaling also requires national public policies that are conducive to scaling up,¹¹ or at least, policies and programs that do not constrain or inhibit the process of expanding reach. Adequate resources for training must be available to ensure that local personnel have the skills needed to carry out the implementation program and to invest in sustainable human resources.¹⁵ Furthermore, efforts at scaling up must be supported by appropriate delivery mechanisms, including the logistics surrounding the delivery or distribution of the intervention as well as financial resources needed to scale up. Robust systems for monitoring and evaluation designed to ensure pragmatic, timely data collection, and which can be used to improve and redesign the implementation strategy, should be in place from the very start (Table 1).

TABLE 1: Summary of illustrative cases of the scaling-up framework and principles.

Cases	Objective	Efficiency Core	Custom Design
West Africa Onchocerciasis Control Program (OCP) [1974 – 1990] ¹⁶	To reduce the prevalence of “River Blindness” by eradicating infected blackflies.	Aerial spraying of insecticides in rivers where blackflies bred. Also sprayed villages closer to the breeding sites.	None highlighted – this example highlights the era when implementation science was heavily biased towards the replication model for scale.
Indonesia’s Kecamatan Development Program (KDP) [1998–current] ^{17,18}	To alleviate poverty in rural communities, strengthen local government and promote local governance.	KDP’s fiduciary structure of providing block grants to sub-districts and villages for small-scale infrastructure, social and economic activities.	Government acceptance and ownership of KDP; political will and national commitment; also KDP’s scale at the national level occurred in the context of institutional collapse and major economic crisis. In 2013, KDP was incorporated as a new national law.
Oportunidades, Mexico [1997 (Progresa) – current] ¹⁹	To alleviate poverty and build capacity through provision of services to the underprivileged and poor populations in Mexico.	Conditional cash transfers for seeking health, nutrition and education services.	Political, fiscal, and socio-cultural space was created for the program; fiscal and social policies to facilitate demand and supply; robust monitoring and evaluation frameworks are in place.
Roll Back Malaria (RBM) Partnerships across Africa [2005 – current] ²⁰	Package of proven malaria interventions used simultaneously to increase coverage and quickly achieve the optimal health.	Proven malaria interventions: Insecticide treated nets (ITNs), indoor residual spraying, prevention in pregnancy with intermittent treatment.	Distribution system in each country; varying costs of delivery and achieving high coverage.

The new Sustainable Development Goals identify development challenges that can be mitigated by implementing effective solutions at scale, so that the benefits can be extended to a greater proportion and to the most vulnerable populations. Scaling up, by definition, broadens impact. It is more than just sharing knowledge and best practices, however. It requires upfront planning and it has to be intentional, equitable and sustainable. It is, at its core, about implementation, that “last-mile” challenge to ensure health innovations are adopted by the end-users. The challenge of scaling up resides not in the ability of implementers to replicate entire system-solutions, but rather to identify the “efficiency core” of the solution which can be most efficiently adapted and modified to fit varied local contexts.

It is important to realize, however, that scalability is not synonymous with sustainability. The initially successful MNP program in Mongolia has recently run into trouble because of financing and the withdrawal of the World Vision partnership. A sustainable strategy for scaling up requires long-term commitments as well as sufficient time for the process to occur (e.g., 10–15 years in some cases).

As of last year, according to UNICEF, the scaling-up of MNP programs has tripled from four in 2011 (Bangladesh, Bolivia, Do-

minican Republic and Mongolia) to 13 in 2013. In this article, we have identified some of the principles that might have enhanced the scaling-up of MNP programs.

Correspondence: Stanley Zlotkin,

Centre for Global Child Health, 525 University Avenue, Suite 701, Toronto, Ontario, M5G 2L3, Canada.

Email: stanley.zlotkin@sickkids.ca

References

01. United Nations. United Nations Millennium Development Goals (MDGs). New York: United Nations, 2013. Retrieved April 15, 2013, from www.un.org/millenniumgoals/.
02. United Nations Children’s Fund (UNICEF). Committing to Child Survival: A promise renewed. New York: UNICEF, 2015. Retrieved September 11, 2015 from: www.apromiserenewed.org/wp-content/uploads/2015/09/APR-2015-9Sep15v2.pdf.
03. United Nations. The Millennium Development Goals Report. New York: United Nations, 2015. Retrieved September 13, 2015 from: [www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20\(July%201\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf).

04. United Nations. Transforming our world: The 2030 agenda for sustainable development. New York: United Nations, 2015. Retrieved September 13, 2015 from: <https://sustainabledevelopment.un.org/content/documents/7891Transforming%20Our%20World.pdf>.
05. Mangham LJ, Hanson K. Scaling up in international health: What are the key issues? *Health Policy Plan* 2010;25(2): 85–96.
06. Simmons R, Ghiron L, Fajans P et al. Scaling up health service delivery: From pilot innovations to policies and programmes. Geneva: World Health Organization, 2007.
07. Cooley L, Kohl R. Scaling up: From vision to large-scale change. A management framework for practitioners. Washington, DC: Management Systems International, 2006. Retrieved November 1, 2012, from www.msiworldwide.com/files/scalingup-framework.pdf.
08. Gillespie S, Menon P, Kennedy AL. Scaling up impact on nutrition: what will it take? *Adv Nutr* 2015;6:440–51.
09. Milat AJ, Bauman A, Redman S. Narrative review of models and success factors for scaling up public health interventions. *Implement Sci* 2015;10:113. doi: 10.1186/s13012-015-0301-6
10. Wong J, Zlotkin S, Ho C et al. Replicating parts, not the whole to scale. *Stanford Innovation Review*, August 7th, 2014. Retrieved September 15, 2015 from: www.ssireview.org/blog/entry/replicating_parts_not_the_whole_to_scale.
11. Yamey G. Scaling up global health interventions: A proposed framework for success. *PLoS Medicine*, 2011;8(6):e1001049.
12. World Vision Mongolia. Effectiveness of home-based fortification of complementary foods with Sprinkles in an integrated nutrition program to address rickets and anemia. Ulaanbaatar, Mongolia: World Vision Mongolia, 2005. Retrieved September 15, 2015 from <http://wvi.org/nutrition/publication/mongolia-sprinkles-evaluation-report-2005>.
13. Banerjee AV, Duflo E. Poor economics: A radical rethinking of the way to fight global poverty. New York: Public Affairs, 2011.
14. Soman D, Stein J, Wong J. Innovating for the Global South: Towards an Inclusive Innovation Agenda. Toronto: University of Toronto Press, 2014.
15. UN Millennium Project. Investing in Development: A Practical Plan to Achieve the Millennium Development Goals. New York, 2005. Retrieved on September 15, 2015 from: www.unmillenniumproject.org/documents/MainReportComplete-lowres.pdf.
16. Rougemont A. The 'River Blindness' Control Programmes OCP and APOC in Africa: A Critical Review. 2007. Retrieved on April 15th, 2014 from: <http://ssrn.com/abstract=1019729>.
17. The International Bank for Reconstruction and Development. Indonesia's Kecamatan Development Program: A large-scale use of community development to reduce poverty. In: Scaling Up Poverty Reduction: a global learning process and conference – case study summaries. World Bank, 2004. Retrieved on January 3, 2013 from: http://web.worldbank.org/archive/website00819C/WEB/PDF/SCALING_PDF.
18. Majeed R, Freidman J. For the people, by the people in Indonesia. How one of Southeast Asia's most corrupt countries gave power over funding to its poorest citizens. Democracy Lab, October 16, 2014. Retrieved on September 17, 2015 from: <http://foreignpolicy.com/2014/10/16/for-the-people-by-the-people-in-indonesia>.
19. Van de gaer D, Vandenbossche J, Figueroa JL. Children's health opportunities and project evaluation: Mexico's Oportunidades program. Center for Operations Research and Econometrics (CORE) Discussion Paper, Université catholique de Louvain. 2012. Retrieved December 9, 2012 from <http://econpapers.repec.org/paper/corlouvco/2012015.htm>.
20. Steketee RW, Campbell CC. Impact of national malaria control scale-up programmes in Africa: magnitude and attribution of effects. *Malar J* 2010; 9:299.

5 GENDER EQUALITY

.....
Good nutrition supports
women's development
.....



Nutrition: A Critical Pathway to the Achievement of the New Global Goals

Ray Chambers

United Nations Secretary-General's Special Envoy for Financing the Health Millennium Development Goals and for Malaria, New York, USA



Ray Chambers: "The MDGs have shown us that investing in nutrition brings about high returns."

As the world transitions from the Millennium Development Goals (MDGs) toward the recently adopted Sustainable Development Goals (SDGs), we have a responsibility to reflect on what has been learned during the MDG era to help inform our path toward achieving the next development agenda.

Over the past 15 years, the eight MDGs have brought about an unprecedented level of commitment and focus on saving lives

across the globe. In the quest to achieve MDG4, the deaths of over 34 million children were prevented – which is estimated to return over US\$3.8 trillion to economies in the developing world. MDG6 garnered attention to specific infectious diseases – malaria, tuberculosis and HIV/AIDS. The world saw immense successes in these areas: over 6.2 million malaria deaths were averted during the MDG era – most of these in children under five years of age in Sub-Saharan Africa; the tuberculosis mortality rate fell by nearly half from 1990 to 2013; and antiretroviral therapy for HIV was scaled up immensely – from reaching only 800,000 people in 2003 to reaching 13.6 million by June 2014. We also witnessed remarkable reductions in maternal deaths (MDG 5). Between 1990 and 2013, maternal deaths declined by 45%, to an estimated 289,000 deaths per year.

These numbers represent real people – healthy mothers seeing their pregnancies to full term, newborns developing optimally, children celebrating their milestone fifth birthday, and stronger communities poised to thrive with the growth of a healthy and productive workforce.

“Nutrition will continue to be a key factor in the success of the SDGs”

Nutrition has been a critical pathway to success during the MDG era, and will continue to be a key factor in the success of the SDGs. Nutrition is an underlying factor in nearly half of all child deaths, and the prevention of chronic undernutrition – stunting – is included in SDG2 but will also be important for the achievement of SDG3, which calls for an end to preventable deaths of newborns and under-five children.

It will be nearly impossible for the world to reach the SDG3 target without accelerating progress in the fight against under-

nutrition. While the number of children suffering from stunting declined from 255 to 159 million from 1990 to 2014, the problem has actually worsened in Sub-Saharan Africa. There is much more work to be done during the SDG era to reduce the number of stunted children to the target level of less than 100 million by 2025, contributing to the achievement of both SDGs 2 and 3.

Lessons learned during the MDG period

As we consider how progress in the fight against malnutrition links to the achievement of many of the SDGs, we should consider some of the major lessons learned during the MDG period:

1) Leadership is crucial: The establishment of the Scaling Up Nutrition (SUN) Movement in 2010 brought global-level leadership to the nutrition space, supporting 55 member countries and establishing four core networks for donors, business, civil society organizations, and UN agencies to better engage in nutrition. The SUN movement aimed to heighten awareness of the importance of nutrition to improving maternal and child survival, and succeeded in elevating this issue on the global development agenda. It is imperative that leaders across the SUN movement should build upon this success to mobilize action across all of its stakeholder networks to deliver on the promises of better nutrition at scale in the post-2015 era.

2) Roadmaps and innovative funding models are needed: My first-hand experience with malaria during the MDG era showed what could be done when roadmaps and plans were created and shared. Countries with well crafted, quarter-by-quarter plans that were shaped with regional input were far more successful at securing the needed funding, driving complex operations and holding leaders accountable in the quest to save more lives. We very much need these roadmaps to achieve our nutrition goals – globally, as well as country-by-country.

Traditional forms of development assistance have been critical to the achievements realized under the MDGs, and these levels must be maintained in the SDG era. Yet, in order to advance progress on this even more ambitious development agenda, we must partner more closely with the private sector to explore and execute innovative funding approaches and business models to finance health and nutrition. In the final year of the MDGs, we've worked with select governments and partners at the World Bank, UNICEF, the Power of Nutrition, the Micronutrient Initiative, the Global Alliance for Improved Nutrition (GAIN), UNITLIFE, GBC Health, Clinton Health Access Initiative (CHAI), DSM/*Sight and Life* and more to identify opportunities to inject

more funding for health, including through innovative finance tools such as leveraging agreements, impact bonds, debt buy-downs, and more. New financing approaches can positively disrupt “business as usual,” and in turn, advance progress on the SDGs.

3) Integration across sectors is essential: Nutrition is a cross-cutting issue, which can have an impact on health, education, women's empowerment, and many other sectors. Multi-sectoral approaches to development should be the new normal, not the exception. There are countless opportunities to build on existing platforms to deliver additional interventions and commodities, such as providing better nutrition through school feeding programs, or reaching adolescent girls with iron and folic acid supplementation through reproductive health and family planning platforms. The proactive identification of integration opportunities, and the implementation of integrated programs, will help to ensure that vulnerable communities are truly offered opportunities for sustainable development – this is an opportunity that they deserve. The fact that there are no “ministries of nutrition” in most countries complicates in-country plan generation and multi-sectoral collaboration, and I would suggest we give real consideration to how the coordination at country-level across sectors might be better pulled together.

“Multi-sectoral approaches to development should be the new normal”

The MDGs have shown us that investing in nutrition brings about high returns – and with an increased focus on nutrition as part of the achievement of the SDGs, the world will see these tangible returns, both in human and economic capital, by the next generation.

I would like to close by thanking the multitude of committed health and nutrition champions around the world who have brought us to where we are today. I am confident that they will build upon the successes and lessons learned from across the MDG period, and lead the charge over the next 15 years to achieve the Global Goals for Sustainable Development.

Correspondence: **Ray Chambers,**

Office of the UN Secretary-General's Special Envoy for Financing the Health Millennium Development Goals for Malaria, New York, USA **Email:** ray.chambers@mdghealthenvoy.org

Transparency and Accountability for Improving Global Governance in Nutrition

Jessica Johnston

Deputy Chief of Staff, Office of Reid Hoffman,
Mountain View, California, USA

Key messages

- > Transparency and accountability are, and will continue to be, critical practices in achieving better nutrition at scale.
- > The nutrition community has developed a variety of frameworks, tools and organizational approaches to drive transparency and accountability in nutrition.
- > These frameworks and approaches provide a strong foundation for nutrition in the post-MDG development era, with substantial room for learning and improvement in the first years of the SDGs.
- > In global public health, there exist accountability tools and approaches from which nutrition leaders may draw applicable tactics/uses to strengthen overall accountability and action in nutrition.
- > To apply many of the successful approaches from the public health sector, leaders from the nutrition community must leverage their positions of power to engage all stakeholders in paving a path forward for stronger transparency and accountability in nutrition.

Transparency and accountability are pillars of global governance in nutrition. These practices are the glue that connects commitments to action.¹ Strengthening the commitments and actions of all stakeholders – governments, business and civil society – is one of the key themes of the 2015 Global Nutrition Report.²

The 2015 SUN Global Gathering hailed accountability as a cornerstone for effective partnerships to deliver on the promises of improved nutrition, which include health, social and economic benefits (see **Table 1**).

However, driving accountability in nutrition is challenging for many reasons. Monitoring action and commitments to nutrition requires leaders from different sectors (e.g., health, education, and agriculture) to advance coordinated action at the global, regional, national, and community levels. Also, driving accountability is further complicated by a lack of trust across key stakeholder groups in business, civil society and government, as well as in donor organizations.^{2,4}

As the international nutrition community positions itself to work within the new, ambitious Sustainable Development Goals (SDG) agenda, all stakeholder groups must find a way to address the lack of trust and complex stakeholder ecosystem to build more of the effective partnerships that are needed to achieve our commitments to nutrition.⁵

“All stakeholder groups must find a way to build more effective partnerships”

The release of the 2015 Global Nutrition Report is the latest stride in a series of efforts aimed at improving transparency and accountability in nutrition. The report confronts the issues of poor quality commitments, lack of transparency, and the lack of

TABLE 1: Select benefits associated with eliminating undernutrition in young children.

Boost GNP by 11% in Africa and Asia	Further boost GNP by supercharging the demographic divide	Prevent more than one third of child deaths per year
Reduce burden of disability for children under 4 years of age by more than half	Increase school attainment by at least one year	Boost wage rates by 5%–9%
Make children 33% more likely to escape poverty as adults	Make women 10% more likely to own their own business when they become adults	Break the intergenerational cycle of poverty

Adapted from Haddad 2012³

trust across stakeholder groups, and this year added a chapter dedicated to the private sector, proposing a set of recommendations for improving accountability and building trust across the nutrition landscape. **Tables 2 and 3** provide an overview of some of the existing nutrition-related accountability frameworks, tools and organizational approaches in place to support transparency and accountability.

The community has built a strong foundation from which to work to ensure accountability in nutrition. However, in order to fully optimize the investments made in this area over the years, nutrition leaders will need to follow the example of the approaches and tactics employed by other sectors – namely global public health – if they are to fully optimize and improve upon existing accountability mechanisms and thus drive better, faster results in nutrition. These include, but are not limited to, elevating visibility of results above and beyond the nutrition community to heads of state and international media; more inclusive

and constructive engagement with the private sector; alignment with other sectors, especially the humanitarian space; and, last but not least, the Global Goals.

“In the health sector, three accountability tools stand out”

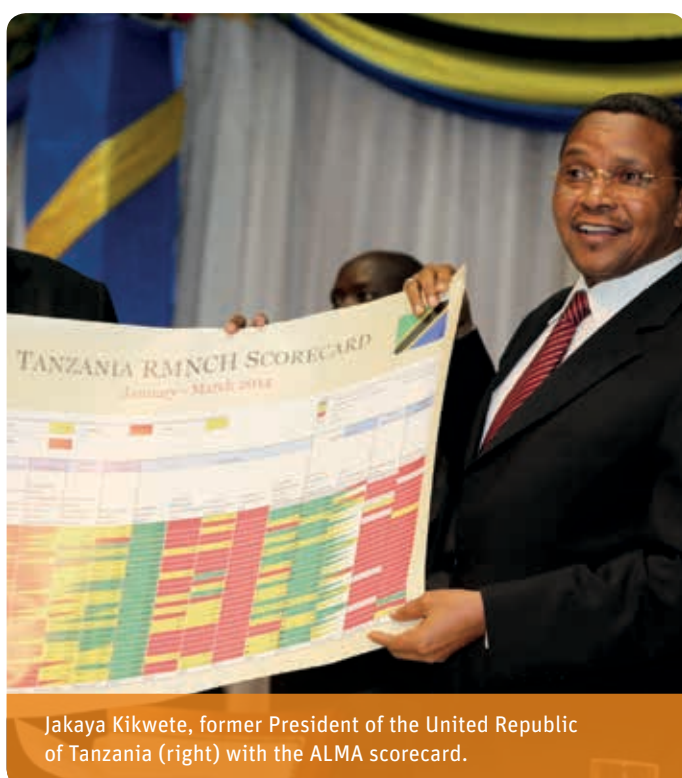
Other accountability tools and approaches from the health sector

In the health sector, three accountability tools stand out as particularly relevant examples from which nutrition leaders can draw applicable tactics and uses to strengthen overall accountability and action in nutrition.

1) The **ALMA Scorecard** is a management and accountability tool created by the African Leaders’ Malaria Alliance (ALMA) – a coalition of 49 African Heads of State and Government working across country and regional borders to reduce deaths from malaria in Africa.¹⁷ The Scorecard is used at forums for Heads of State and Ministers of Health, where stakeholders review progress and address challenges related to meeting malaria targets. The Scorecard supports country- and regional-based monitoring and accountability systems that track results on a quarterly basis, while helping stakeholders identify bottlenecks and facilitate appropriate action to reduce malaria. This latter function allows many countries to use the Scorecard as a management tool at national, regional and district or community levels.

ALMA’s work in developing, implementing and using the scorecards at various forums has been critical to keeping malaria high on the political agenda in recent years, which has translated into a strong, enabling environment for financing and action on malaria on the ground.

In the SDG era, nutrition leaders may take a leaf out of the ALMA/malaria community’s copybook on two fronts: **(1)** seek out opportunities to regularly engage heads of state and other politically influential leaders to review and highlight progress and challenges in nutrition and sustainable development;



Jakaya Kikwete, former President of the United Republic of Tanzania (right) with the ALMA scorecard.

TABLE 2: Frameworks and tools for improving accountability in nutrition ^{6,7,8,9,10,11}

Accountability framework Mechanism description	Intended audience Primary users				
	Government	Civil society	Donors	Private	Academia
<p>Hunger and Nutrition Commitment Index (HANCI)</p> <p>This index compares and ranks developing countries whose hunger and undernutrition status is considered severe or alarming.</p> <p>> HANCI evolved from the Hunger Reduction Commitment Index (HRCI), by adding and de-coupling hunger and nutrition commitments under three themes: spending, policies and laws. Indicators are split between commitment to hunger reduction (10 indicators) and commitment to addressing undernutrition (12 indicators).</p>	X	X	X	X	X
<p>Global Nutrition Report (GNR)</p> <p>This report aims to provide another layer of accountability in nutrition at the global, regional and national levels through reviewing existing processes, highlighting progress in combating malnutrition, identifying gaps, and proposing ways to fill them.</p> <p>> Through this, the GNR helps to guide action, build accountability and spark increased commitment for further progress towards reducing malnutrition much faster.</p>	X	X	X	X	X
<p>Access to Nutrition Index (ATNI)</p> <p>This index assesses and ranks the world's largest manufacturers on their nutrition-related commitments, practices and performance.</p> <p>> ATNI aims to encourage companies to increase consumer access to nutritious products and responsibly exercise their influence on consumer choice and behavior.</p> <p>> The ultimate goal is to facilitate improved diets and a reduction in the serious global problems of both obesity and undernutrition.</p>		X	X	X	
<p>FTSE4 Good Index Series</p> <p>This series of Indices is designed to measure the performance of companies demonstrating strong Environmental, Social and Governance (ESG) practices.</p>		X		X	
<p>Global Hunger Index (GHI)</p> <p>This index measures and tracks hunger by country, by region and at a global level. It highlights successes and failures in hunger reduction and provides insights into the drivers of hunger.</p> <p>> The GHI combines three equally weighted indicators – undernourishment, child underweight, and child mortality – in one index number.</p> <p>> The GHI ranks countries on a 100-point scale. Zero is the best score (no hunger), and 100 is the worst, although neither of these extremes is reached in practice.</p>	X	X	X		X

Use

Notes for discussion; what's missing

The HANCI shows that committing to hunger reduction is not the same as committing to improve nutrition. The Index appears to have been used effectively by individuals and organizations engaged in research and advocacy to understand and influence the commitments of governments and donors to reducing hunger *and* improving nutrition.

How to integrate this index with other efforts?

> Risk of redundancy in reporting and data.

Used as a resource for stakeholders to advocate increased financing, policy changes and greater cross-sector accountability and engagement. May also be used to drive greater transparency and, in turn, accountability, around commitments to improve and/or finance nutrition (e.g., tracking N4G commitments), increased financing, policy changes and greater cross-sector accountability and engagement.

The 2015 report highlights the need for greater accountability in nutrition, dedicating two chapters to new approaches to reinforce regulation and legislation as key mechanisms for improving enforcement in nutrition.

> However, not enough attention is paid to how civil society should be held to account. The assumption is that civil society doesn't need it, but citizens have interests that must be understood and made transparent, too.

> The GNR dedicates 2 out of 10 recommendations to the theme of strengthening accountability. The Report may be difficult for nutrition practitioners to use, especially those operating at community levels where nutrition program implementation is often taking place.

Companies with relatively strong rankings use the ATNI as a means to highlight their positive contributions to global development and nutrition.

Problem = self-reported data?

> Coming soon: will also develop and publish

Advocates and policy organizations use the index to try to drive greater accountability in the private sector.

"Spotlight Indexes" that score and rate the largest Food & Beverage manufacturers in each Spotlight Country.

Used by fund managers and investors in four main ways:

- 1) To create financial products focused on responsible investment;
- 2) To identify environmentally & socially responsible companies;
- 3) As a reference for transparent and evolving global ESG standards;
- 4) As a benchmark to track the performance of responsible investment portfolios.

Conducts only limited assessment of the health and nutrition impacts

of products. Recent research suggests that inclusion in, or exclusion from, the index does not significantly affect firm behavior (Curran and Moran¹⁰) and that investors focusing on the indices do no worse on average than those who invest without regard to them (Collison et al⁹).

The index is updated annually and used to raise awareness and understanding of regional and country differences in hunger, and to trigger actions to reduce hunger.

How to integrate this index with other efforts?

> Risk of redundancy in reporting and data.

> How could this be combined with HANCI?

TABLE 3: Organizational approaches aimed at improving accountability in nutrition ^{12,13,14,15,16}

Organizational approaches aimed at improving accountability in nutrition	Practical application
<p>WHO Nutrition Governance Score</p> <p>Assesses a country's commitment to nutrition through examining the presence of key elements that include the existence of a national nutrition plan/strategy, adoption of a national nutrition policy, regular nutrition monitoring and surveillance, the existence of a line item for nutrition in the health budget, and more. A value of 1 is afforded to the presence of each element, with the governance scores ranging from 0 to 11. The strength of nutrition governance was considered <i>weak</i> for countries scoring from 0 to 6.9, <i>medium</i> for those scoring from 7 to 9.9, and <i>strong</i> for those scoring from 10 to 11.</p>	<p>The WHO uses this score to inform the agency's prioritization of nutrition investments in many of the countries where it operates.</p>
<p>Committee on World Food Security (CFS)</p> <p>An intergovernmental body for coordination, policy convergence and coherence, as well as support and advice to countries and regions. The committee is open to all UN member states. As at 2012, the Committee had 126 members.</p>	<p>The Committee collects, conducts and disseminates research/evidence to support member states in their work to improve Food Security.</p>
<p>Scaling Up Nutrition (SUN) Movement</p> <p>The SUN Movement aims to support all nutrition stakeholders to help them create an enabling environment for nutrition, share best practices across countries/regions, align around costed country plans, and increase resources allocated to coherent aligned approaches designed to scale up nutrition. The SUN Movement is open to all countries and their stakeholders. At the end of 2015, the Movement had 56 member countries.</p>	<p>The SUN Movement has created Business, Civil Society, UN and Donor networks that are intended to mutually reinforce accountability across nutrition stakeholder groups through transparent reporting and use of data, as well as other practices. SUN holds an annual Global Gathering for its members, as well as numerous in-country and virtual meetings, to drive these transparency and accountability efforts.</p>
<p>United Nations Standing Committee on Nutrition (UNSCN)</p> <p>The SCN serves as a platform to improve cooperation among UN agencies and partner organizations (at all levels) engaged in nutrition-related work. The SCN's membership comprises UN agencies and other UN platforms.</p>	<p>The UNSCN works with its members to harmonize policies and strengthen the coherence and impact of nutrition work through better cooperation and coordination across the UN nutrition community.</p>
<p>UN REACH</p> <p>A partnership of the WFP, UNICEF, FAO, IFAD and WHO. Originally, the partnership was intended to strengthen UN efforts towards ending poverty and hunger by 2015 (MDG1). However, as momentum has grown behind Nutrition, and reflecting the creation of the SUN Movement, REACH has expanded its focus and action plans to include a stronger emphasis on nutrition issues. The Partnership currently has operations in 12 countries.</p>	<p>The Partnership works to assist governments of countries with a high burden of child and maternal undernutrition to accelerate the scale-up of food and nutrition actions.</p>

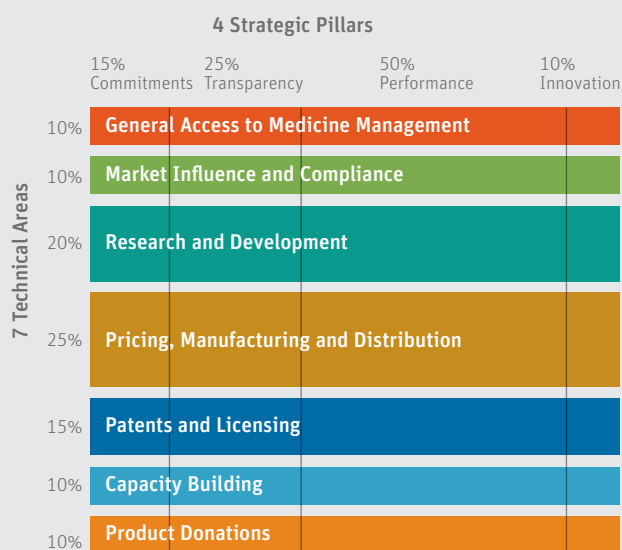
(2) consider creating a multi-sector nutrition scorecard. The Government of Tanzania has embarked on such an endeavor. This can serve as a model for other governments to follow, and can catalyze regional action.

2) The **Access to Medicine Index (ATMI)** is similar to the ATNI (Table 2) in that it seeks to capture private-sector contributions to a key indicator for improved global public health: access to medicine.¹⁸

Published every two years since 2008, the ATMI is an independent ranking of the top 20 research-based pharmaceutical companies, based on their efforts to improve access to medicine for people living in developing countries. The framework is constructed around seven technical areas including pricing, intel-

lectual property, and public policy, and is examined through the lens of four pillars: commitment, transparency, performance and innovation (see Figure 1). The ATMI is credited with improving private-sector engagement in health, and significantly increasing access to medicines for low-income and other vulnerable populations around the world.

The index is regarded as one of the most robust accountability mechanisms in global public health for the Health Millennium Development Goals (MDGs). In 2013, the MDGs Gap Task Force included ATMI results in its report because it recognized that it was "important to monitor and evaluate what pharmaceutical companies themselves, as the producers and suppliers of medicines, [were] doing to increase access to their products."

FIGURE 1: ATMI Methodological Framework.

Evolution of the framework: For the 2016 Index, the weighting of the Performance pillar has increased to 50%. For the previous two Indices, its weighting remained static at 40%.

From Access to Medicine Index, 2012

To strengthen its alignment and ability to drive action, the ATMI will be updated to track company progress against specific SDGs, including capacity building (SDG 9), participatory processes (SDG 16), and multi-stakeholder partnerships (SDG 17), in addition to direct action on improving health (SDG 3).

In addition, the ATMI is a good example of a mechanism that has catalyzed further action beyond simply serving as a tool to track commitments. For example, the results of the index are covered by top media outlets, such as the Financial Times and New York Times, whose coverage influences the global reputations of the pharmaceutical companies and, in turn, helps drive their desire to improve their ranking. The result has been to induce a positive competitive environment that encourages a corporate race to the top of the rankings. Also, the index helps employee engagement and professional development within companies by facilitating the engagement of internal specialists with senior managers and other departments within and across organizations. After the publication of each Index, the Access to Medicine Foundation engages with pharmaceutical companies to explain their scores and the recommendations included in the report. During these conversations, companies confirm that this index is an important tool for raising the awareness of access-to-medicine issues across business units. Many of these tactics could be adopted by nutrition leaders.

3) The **Core Humanitarian Standard (CHS)** – a set of commitments that humanitarian organizations should voluntarily meet in order to improve the quality and effectiveness of their assistance.¹⁹ Today, an estimated 23% of the world's poorest families live in fragile states and conflict regions. Pregnant women and young children living in these areas are especially vulnerable to poor nutrition and death from preventable causes. At the New York launch of the 2015 GNR, International Rescue Committee CEO David Miliband made a forceful plea for better partnership and collaboration across the humanitarian and global development community.²⁰ Launched in late 2014, the new standards aim to further strengthen the focus on accountability in humanitarian assistance in terms of budget transparency and on consulting with communities.

The CHS presents an opportunity for stakeholders in the nutrition space to better partner with actors from the humanitarian space and other sectors to strengthen standards for supporting nutrition in health as well as in emergencies. For example, refining the protocols for delivering emergency supplementary feeding programs, as well as integrating nutrition programming (and financing) between emergency and development contexts would allow for better coverage of key nutrition interventions and more flexible responses, including the continuation of nutrition programs in the post-emergency period. The GNR notes that donors could be asked to report on any such financing activity in future reports.

New ways of working together

The nutrition community is transitioning from the MDG era to a post-2015 development agenda that is packed with ambitious global goals, including the Nutrition for Growth targets for 2020, the World Health Assembly targets for 2025, and the Sustainable Development Goals for 2030.

Transparency and accountability are crucial to building and sustaining the partnerships necessary to achieve the post-MDG era targets. Therefore, efforts must be made across the board to acknowledge the interests of *all* stakeholder groups – private sector, civil society, government and donor organizations – and in turn, the employment of approaches and tools that have been developed by the health sector and which help drive accountability in business, as well as in government, civil society and donor organizations.

We need leaders such as Ertharin Cousin of the World Food Programme, Margaret Chan of the World Health Organization, and Gerda Verburg of the Committee on World Food Security (CFS) and her successor, Hassan Gornass, to use their convening power to bring all stakeholders to the table and demand accountability and transparency from all parties. The challenges are enormous, and therefore we need to break away from “business as usual.” We need innovative, multi-stakeholder partner-

ship models, and we need leaders in nutrition to truly seek these models out. For example, in the final phase of drafting the WHO Framework for Engagement with Non-State Actors, nutrition leaders have an opportunity to break away from “business as usual” and lead the way towards improving transparency, accountability and trust in this new development era.²¹ This opportunity should not be missed.

Nutrition affects all of us: everyone should be at the table.

.....

“Nutrition affects all of us: everyone should be at the table”

.....

Correspondence: *Jessica Johnston,*

*Deputy Chief of Staff, Office of Reid Hoffman,
2029 Stierlin Ct, Mountain View, CA 94043 USA*

Email: jljohnston@linkedin.com

.....

Acknowledgements

*Klaus Kraemer, Jess Fanzo, Quinn Marshall, Eva Monterrosa
for their review and comments on the article.*

.....

References

01. Fanzo J et al. Nutrition governance: a literature review prepared for the Columbia University Sustainable Development Practicum with UN REACH. May 2012.
04. International Food Policy Research Institute. Global Nutrition Report 2015: Actions and Accountability to Advance Nutrition and Sustainable Development. Washington: IFPRI, 2015.
03. Haddad L. (Institute for Development Studies). Child Growth = Sustainable Economic Growth: Why we should invest in Nutrition. Policy Brief. London: Children’s Investment Fund Foundation, 2013.
04. Chan M. Address by Director-General of WHO to 65th session of the Regional Committee. Available from: www.euro.who.int/en/about-us/governance/regional-committee-for-europe/65th-session/speeches-and-presentations/address-by-dr-margaret-chan,-director-general-of-who. [Cited 10 August 2015].
05. United Nations Sustainable Development Goals. c2015 [updated 13 Oct 2015; cited 6 Oct 2015]. Available from: www.un.org/sustainabledevelopment/sustainable-development-goals/.
06. Hunger and Nutrition Commitment Index (HANCI). c2015 [cited 15 August 2015]. Available from: www.hancindex.org/the-index/
07. Access to Nutrition Index (ATNI). c2013-2015 [cited 15 June 2015]. Available from: <https://www.accesstonutrition.org/objectives-0>.
08. Lintelo D, Haddad L, Leavy J et al. Measuring the Commitment to Reduce Hunger: The Hunger Reduction Commitment Index. Institute of Development Studies and Irish Aid, 2011. Retrieved from <http://hrcindex.files.wordpress.com/2011/09/hrci-final-report-for-web-draft.pdf>.
09. Collison DJ, Cobb G, Power DM et al. The financial performance of the FTSE4Good indices. *Corporate Social Responsibility and Environmental Management* 2008;15:14–28. doi:10.1002/csr.144.
10. Curran M, Moran D. Impact of the FTSE4Good Index on firm price: An event study. *J Environ Manage* 2007; 82:529–53.
11. IFPRI. Global Hunger Index (GHI). c2015 [cited 15 June 2015]. Available from: www.ifpri.org/topic/global-hunger-index.
12. World Health Organization. Country typologies for “readiness” to accelerate action in nutrition. c2015 [cited 15 June 2015]. Available from: www.who.int/nutrition/landscape_analysis/typologies/en/.
13. UN Food and Agriculture Organization. Committee on World Food Security (CFS). c2015 [cited 15 June 2015]. Available from: www.fao.org/cfs/cfs-home/en/.
14. Scaling up Nutrition Movement (SUN). c2015 [cited 15 June 2015]. Available from: <http://scalingupnutrition.org/about>.
15. United Nations Standing Committee on Nutrition (UNSCN). c2015 [cited 15 June 2015]. Available from: www.unscn.org/en/activities/.
16. UN REACH. Accelerating the Scale-up of Food and Nutrition Actions. c2015 [cited 15 June 2015]. Available from: www.reachpartnership.org/about-reach;jsessionid=5ECF76A0413EFD17C70C3D223483F003
17. ALMA2030 African Leaders Malaria Alliance. c2009-2015 [cited 15 June 2015]. Available from: <http://alma2030.org/scorecards-and-reports/map>.
18. Access To Medicine Foundation. c2012 [cited 6 Oct 2015]. Available from: www.accesstomedicineindex.org/about-index.
19. Core Humanitarian Standard. c2015 [cited 15 Oct 2015]. Available from: www.corehumanitarianstandard.org/the-standard.
20. Miliband D. Panel Discussion at the 2015 Launch of the Global Nutrition Report. New York, 22 September 2015.
21. World Health Organization. WHO’s engagement with non-state actors. C2015 [cited 15 Oct 2015]. Available from: www.who.int/about/collaborations/non-state-actors/en/.

Reflections on Nutrition Leadership Capacity Development

Johann Jerling

Centre of Excellence for Nutrition
at North-West University, Potchefstroom Campus,
Potchefstroom, South Africa

As we enter a new phase in history with the acceptance of the Sustainable Development Goals (SDGs) and we continue our quest for a better world, it is appropriate to reflect on how we will shape this new future amid immense optimism but also significant skepticism.

For many years, capacity-building efforts have focused on amassing technical and physical capacity at the expense of capabilities that are more often associated with improving effective team functioning. Although significant strides have been made in building capacity, it is also safe to say that we have not been completely successful in shaping our world.

Consistently, including in the recent Lancet 2013 series on nutrition, capacity development and leadership development are recognized as key to the success of scaling up interventions.¹ A 2011 capacity assessment of mid-level nutrition workers² showed that one of the challenges faced in the workforce environment is the lack of effective leadership, management, mentoring and supervision skills to improve quality standard and performance.

The Scaling Up Nutrition (SUN) Movement has created an unprecedented willingness to improve nutrition at a global and national level. An abundance of evidence exists regarding the interventions that would be efficacious in alleviating various forms of undernutrition. Over the past few decades, dedicated attention has been given to building capacity, with a focus on technical knowledge and skills. At the same time, the nutrition community has come to the clear realization that the solutions to many nutritional problems lie in an effective multisectoral and trans-disciplinary approach.³

It has also been recognized that the ability to convert well-constructed plans into action, at the *program implementation level*, is a critical success factor. Strategic plans, and the nec-

essary resources, are vital for creating strong implementation systems, which are all prerequisites for the eventual success of nutrition interventions. However, the structured attention necessary for building the required leadership capacity has been lacking.

**“The solutions to
many nutritional problems lie
in a multisectoral and
trans-disciplinary approach”**

Among the ten key recommendations of the Global Nutrition Report (2014)⁴ is the recommendation that governments, international partners, and businesses should “*invest strategically, systematically, and in a sustained manner, in nutrition leadership programs to scale up the numbers and reach of nutrition champions (the African Nutrition Leadership Programme is a good example of a program that has the potential for scale-up).*”

We often erroneously use the terms leadership and management interchangeably. Prof. John Kotter explains the difference as follows: “Management is a set of well-known processes, like planning, budgeting, structuring jobs, staffing jobs, measuring performance and problem-solving, which help an organization to predictably do what it knows how to do well. Management helps you to produce products and services as you have promised, of consistent quality, on budget, day after day, week after week. In organizations of any size and complexity, this is an enormously difficult task. We constantly underestimate how complex this task really is, especially if we are not in senior management jobs. So, management is crucial — but it’s not leadership.”⁵

**“Management is crucial —
but it’s not leadership”**



Diversity makes for stimulating learning environments. ANLP participants from Sudan, Cameroon, Nigeria, Niger and South Africa.

Kotter goes on to state that: “leadership is entirely different. It is associated with taking an organization into the future, finding opportunities that are coming at it faster and faster, and successfully exploiting those opportunities. Leadership is about vision, about people buying in, about empowerment and, most of all, about producing useful change. Leadership is not about attributes, it’s about behavior. And in an ever-faster-moving world, leadership is increasingly needed from more and more people, no matter where they are in a hierarchy. The notion that a few extraordinary people at the top can provide all the leadership needed today is ridiculous, and it’s a recipe for failure.”

.....
**“We need superb management,
 but we need more superb leadership”**

Another error in reasoning is to argue that management must be replaced with leadership. This is incorrect: they serve different, yet essential, functions. Kotter says that we need superb management but we need more superb leadership. We need to make our structures, systems and organizations reliable and efficient. We also need to take them into the right future – into this new vision that we have created in the SDGs, the vision that we have described in the SUN. When we talk about leadership, we are not referring to those people at the top of a hierarchy; we refer to a set of orientations and behaviors that enable us to achieve change. Leaders are required throughout the whole system, and they lead from where they stand.

Leading change

At the African Nutrition Leadership Programme (ANLP), we are continuously refining a model of leading change that was originally developed by Prof. Leon Coetsee from the North-West University Business School in South Africa. The validation of the model in a multisectoral working environment is an ongoing process. The model consists of a number of principles that are applied in a non-sequential manner and include steps to:

- > Determine the reasons for a change process, and the outcomes it should deliver;
- > Determine if the defined end-purpose reflects a real need for change;
- > Perform a stakeholder analysis and plan to create stakeholder-aligned commitment to the purpose and process of change, by applying the aligned commitment equation and using embedding mechanisms to sustain energy and effort;
- > Ensure the availability of a wide range of transformational leadership skills and grow transformational leadership orientations, attitudes, skills and other competencies;
- > Diagnose current effectiveness issues (strengths, weaknesses, threats, opportunities, problems, conflicts and dilemmas) that need to be addressed;
- > Integrate the planned implementation of the other eight principles into a comprehensive change intervention plan focused on attaining envisioned purposes and specifying all the necessary activities;
- > Grow knowledge and skills to identify the sources and nature of resistance and the ability to effectively manage resistance to change;
- > Enable an environment and orientations that will facilitate the execution of future change demands; and
- > Develop and perform checks and evaluations to detect obstacles and measure progress, along with the eventual achievements, in order to redirect and/or adapt change interventions.

This model has proven particularly useful for leading change in multisectoral settings, where it often has to be driven by individuals with delegated duties.

Core assumptions for leadership capacity building

The African Nutrition Leadership Programme consists of a range of leadership capacity development programs. The ANLP approach to leadership capacity development asserts that:

1. Leadership is a body of orientations, attitudes and behaviors that can be acquired and developed;
2. Leadership is not related to a position; leaders lead from where they stand;

TABLE 1: Typical program content for nutrition change interventions

Growth and development at individual level	Multisectoral team growth and development, plus eventual nutrition (-sensitive) intervention outcome
<ul style="list-style-type: none"> > Create an awareness of own leadership orientations, strengths and gaps > Discover own locus of control, personal values and purpose > Grow specific management and leadership orientations and skills such as: <ul style="list-style-type: none"> > Conducting stakeholder analyses > Communication skills > Conflict resolution skills > Decision-making and problem-solving > Designing effective intervention plans > Managing resistance to change > Leading from where you are > Create and implement a personal leadership development plan 	<ul style="list-style-type: none"> > Formulate a purpose statement and evaluate the necessity for change (any kind of change) > Develop skills to gain aligned stakeholder commitment to a shared purpose > Diagnose team effectiveness and other problems and dilemmas > Formulate a comprehensive results-oriented action plan to grow and develop the team and to achieve the overall purpose of change process (intervention) – e.g., enhancing team effectiveness and reducing stunting (NB two elements are involved) > Manage resistance to change > Build a team culture of continuous learning, thinking and growing > Skills and tools to monitor and evaluate progress on all fronts

3. Managerial leadership – a combination of management and especially leadership orientations, attitudes, skills and behaviors – is an important orientation to acquire;
4. Relationships with self and others must be founded on integrity and trust;
5. The result of leadership is to make team members (and thus the organization) successful;
6. Leaders have the responsibility to grow and develop more leaders;
7. The personal ability to change and grow continuously is a requirement for unleashing leaders' own potential as well as the potential of others;
8. Leaders and followers must be committed to serve and find meaning in what they do beyond their own self-interest;
9. Leaders focus team members' energy on achieving objectives that go beyond mere self-interest;
10. Leaders create environments which people want to be a part of rather than just working for the team/organization; and
11. The ability to lead and manage change (nutrition) interventions is a critical success factor and an essential competence in Africa.

Leadership capacity development programs may have a number of general goals, but should include:

- > Creating an awareness of one's own leadership orientation

and ability, and how it influences team and personal effectiveness. All change initiatives start at an individual level;

- > Creating an environment in which individuals can experience their strengths and growth areas and receive feedback on their behavior and their growth;
- > Creating an environment that allows for growth from awareness to attitude to behavior;
- > Promoting an internal locus of control;
- > Developing a personalized action plan for growth beyond the capacity development program;
- > Creating an awareness that leadership is a behavior and not a position;
- > Creating an awareness of the importance of developing others for the greater good rather than to compete;
- > Creating a sense that leaders are accountable to themselves for their own growth;
- > Establishing the practice of reflection as a basis for continued self-discovery and growth;
- > An experience of how leadership capabilities affect team performance and work performance; and
- > An experience of working in diverse teams (cultural, technical, gender etc.).

African Nutrition Leadership Programme

The African Nutrition Leadership Programme is a program developed and hosted by the Centre of Excellence for Nutrition at North-West University in South Africa. The ANLP undertakes two categories of leadership capacity development activities:



Experiential learning, teamwork and case studies are effective tools for leadership capacity development.



1. An annual 10-day leadership development immersion course aimed at developing individuals' leadership capabilities. This has been running for 14 years and has 325 alumni spread over 34 African countries.
2. Tailor-made needs-based leadership capacity development programs focused on developing the abilities of individuals to lead the implementation of nutrition-related interventions as members of multisectoral groups and teams operating on national and district level.

The tailor-made leadership development programs are developed using current best practice from the disciplines of organizational development and change management leadership, as well as from practical experience gained working in Kenya, Zambia, Uganda and Rwanda with multisectoral teams responsible

for nutritional interventions. The programs are all based on real and expressed participant needs as well as their stakeholders' needs, and are designed to be relevant to the target audiences they serve.

Both individual and team growth – in terms of orientations, attitudes, specific leadership skills and transformational leadership applications – are prerequisites for effective nutrition program implementation and the successful achievement of the specific goals and targets. Individual growth feeds into multisectoral team development, and the effective functioning of these teams is then instrumental for implementing nutrition change interventions – which comprises yet another skillset to master. A summary of the typical general program content required is set out in **Table 1**.

In 2010–2011, the ANLP worked with the Kenya Food Fortification Alliance to assist in implementing mandatory food fortification in Kenya. Later, and with support from *Sight and Life*, work was undertaken with the Zambia National Food and Nutrition Commission. In 2015, the ANLP entered into partner-

ship with UNICEF and started working with five multisectoral district teams in Uganda and Rwanda. Another major part of this cooperation agreement was to develop a group of master trainers who will eventually be able to offer leadership development training. By so doing, they will enlarge the capability of the ANLP to offer leadership capacity development programs in Africa.

Developing leadership capacity at all levels is a critical success factor in scaling up nutrition interventions and delivering on the SDGs. Understanding the function and importance of good leadership as well as good management is critical. Change is a process that must be led and developing the capacity to do so effectively at scale requires a long-term commitment and starts at an individual level. Furthermore, it calls for a variety of expertise not necessarily associated with nutrition. If the nutrition fraternity is to effectively make use of the existing momentum to change the nutrition landscape, we will have to invest more effort in developing those individuals who will lead the way at every level.

.....

**“We will have to invest more
in those individuals who will lead
the way at every level”**

.....

.....

Correspondence: *Johann Jerling,*
Centre of Excellence for Nutrition,
Potchefstroom Campus, North-West University,
Private Bag X6001, Potchefstroom, 2520 South Africa
Email: *johann.jerling@nwu.ac.za*

.....

References

01. Gillespie S, Haddad L, Mannar V et al. and the Maternal and Child Nutrition Study Group. The politics of reducing malnutrition: building commitment and accelerating progress. *Lancet* 2013; 382:552–569
02. Mid-level health workers for delivery of essential health services – a global systematic review and country experiences. www.who.int/workforcealliance/knowledge/mlpreport_annexes/en/index.html.
03. Fanzo JC, Graziose MM, Kraemer K et al. American Society for Nutrition. *Adv Nutr* 2015;6:639–47; doi:10.3945/an.115.010041.
04. International Food Policy Research Institute. *Global Nutrition Report 2014: Actions and Accountability to Accelerate the World’s Progress on Nutrition*. Washington, DC: IFPRI 2014.
05. Kotter JP. *Management Is (Still) Not Leadership*, Harvard Business Review, January 9 2013

The Future of the SUN Movement in Light of the Sustainable Development Goals

Tom Arnold

SUN Movement Coordinator Ad Interim,
Palais des Nations, Geneva, Switzerland

In late September, world leaders adopted the 2030 Agenda for Sustainable Development to end poverty, promote prosperity and well-being for all, protect the environment, and address climate change.

The objectives of achieving improved nutrition and building inclusive, resilient and sustainable food systems are central to success of the 2030 Agenda. Without adequate and sustained investments in nutrition, both directly and as part of an integrated set of interventions aimed at ending poverty and hunger, the full potential of the 2030 Agenda will not be realized.

The Scaling Up Nutrition (SUN) Movement contributes to the spirit of strengthened global solidarity, focused on the needs of the poorest and most vulnerable, and with the participation of countries, stakeholders and people. The SUN Movement exists as a manifestation of the belief that only by working together – across the diversity of sectoral approaches, stakeholder interests and institutional mandates – will it be possible to achieve the progressive realization of the right to adequate food, and nutrition justice for all.

“The Scaling Up Nutrition (SUN) Movement contributes to the spirit of strengthened global solidarity”

The 2030 Agenda will require new ways of working. And the SUN Movement, with its multi-sectoral and multi-stakeholder focus, is one of the clearest expressions of realizing that way of working.

As at the end of 2015, the Movement is led by 56 countries and the Indian State of Maharashtra. Together with multiple stakeholders from civil society, United Nations agencies, donors, business and academia, we are all united by our determination to end malnutrition in all its forms. It is within our power to confront and overcome this challenge.

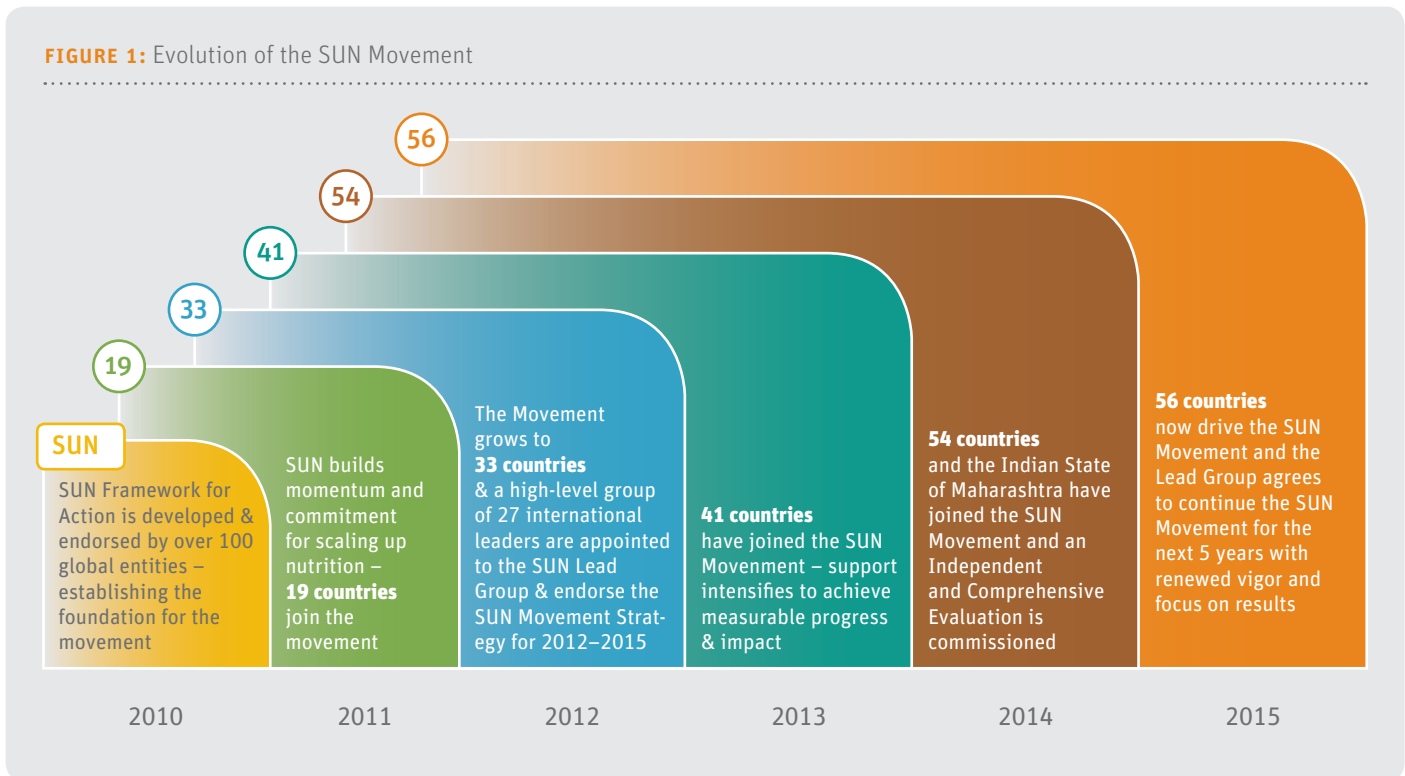
Recent progress

One in three people are affected by malnutrition in nearly every country world-wide. This is a global crisis, but progress is being made, and we know what to do to change the situation. 2015 has been a significant step in walking toward our goal, hand in hand.

Together, we are driven by the commitment and leadership of the countries in the SUN Movement. Progress is being made, with strong political leadership, increased investments, improved alignment, and multi-stakeholder, multi-sectoral collaboration.

Throughout the course of 2014–15, many SUN Countries reported significant progress in reducing stunting, including Benin, Cambodia, Ethiopia, Ghana, Guinea-Bissau, Kenya, Kyrgyzstan, Malawi, Tanzania, Zambia and Zimbabwe.¹ These examples show that the SUN Movement is on the right track, and that our results are better when efforts in different sectors are combined and the programs of different actors aligned. But there is so much more to be done, through sharing what we are doing, pursuing equity for girls, engaging women in decisions, and reporting carefully on progress. Whatever we do, we work better when we are together. Many other countries in the SUN Movement are also making significant strides, with preliminary data showing promising trends, but there is no room for complacency: the risks are too great.

“Whatever we do, we work better when we are together”

FIGURE 1: Evolution of the SUN Movement

Defeating malnutrition, united with multiple sectors and stakeholders in a truly coherent approach, is no longer an abstract aspiration: it is the new normal. This belief is at the core of the SUN Movement.

As lessons learned trickle in from countries reporting progress, we are inspired that the nutrition improvements we advocate are supporting change. The combined power of high-level political commitment paving a path for multi-sectoral action, a supportive policy environment across sectors essential for improving nutrition (such as health, agriculture, education, women's empowerment and water and sanitation), and the scale-up of proven interventions are key ingredients supporting these transformations.

Dedicated and aligned action from all quarters of society based on an agreed and achievable set of nutrition results will further support these changes. This is a challenge to us all: to work better together, to be bold, to be ambitious, to be innovative, and to be accountable to each other.

Following the Independent Comprehensive Evaluation (ICE) of the SUN Movement which concluded in January 2015, the SUN Movement Lead Group was unanimous that the Movement should remain inclusive, multi-stakeholder and multi-sectoral: a “big tent” open to all countries committed to achieving nutrition justice for all.

The next five years of SUN

Guided by the evaluation and subsequent SUN Movement Lead Group decisions, together we are looking forward to the next five years of the SUN Movement. We will ensure that the Movement's

unique advocacy for better nutrition is louder and more visible than ever before. We will continue to enrich the Movement's unique ability to catalyze action, ensure and improve our transparency, and strengthen our emphasis on gender and women's empowerment, climate change, and fighting inequity.

We must also focus our attention on improving the quality and scale of our support to SUN Countries, and on communicating the results better. To remain effective, we must act as an accelerant, guided by the ambitions of SUN Countries and the Agenda 2030, and we must follow the lead set by Member States at the Second International Conference on Nutrition (ICN2).

As we reflect on the progress in 2014–15, it is critical that we set ourselves ambitious goals for 2016. We must all come together in our common mission and maximize existing resources for nutrition. Significant efforts across the SUN Countries in 2015 to put a price tag on nutrition-specific and nutrition-sensitive interventions in their national budgets is a major step in the right direction. It is also evident that with more resources, we can achieve far better things. It is estimated to cost an additional US\$8.50 per child per year or a total of US\$49.6 billion over 10 years, to meet the global stunting targets covering the scale up of high-impact, proven interventions.² There remains a strong and continuously growing consensus that improving children's nutrition is one of the best investments a country can make for its future prosperity. US\$1 invested in stunting reduction generates around US\$16 in economic returns.³

It is incumbent on us all to keep building a smart investment case for nutrition, reinforce our alignment and coordination,

FIGURE 2: The countries driving the SUN Movement

and mobilize resources for the future. At the core of all of this, we must also acknowledge that there will be no sustainable improvements in nutrition unless we empower women and girls and appreciate their crucial role in ending malnutrition. They are leaders in their families, communities and, increasingly, governments: they can lead the way to a healthier, stronger world.

.....

“There will be no sustainable improvements in nutrition unless we empower women and girls”

.....

The fifth year of the SUN Movement has demonstrated that immense energy is driving this collective push for nutrition results, reinforced by a growing mantra that we are all in this together. Global and national level leaders are recognizing the critical importance of investing in nutrition to ensure health and wealth and as a means of building resilience in times of turbulence. But continued momentum cannot be taken for granted. It will need careful nurturing, firstly through consistent advocacy but most of all by proving that the SUN approach is delivering results.

The SUN Movement Strategy and Roadmap 2016–2020

Moving into 2016 and beyond, demonstrating achievements will increasingly become a focus of countries in the SUN Movement.

Stimulating effective action and achievements around nutrition is a long-term project. Documenting and sharing what is and what isn't working should be integral to the SUN Movement. Learning and sharing underpins the SUN Movement, but ensuring that key lessons are extracted, guidance formulated and support extended will be central to success. Those engaged in the SUN Movement understand the importance of supporting tasks critical for sustainability – such as building multi-stakeholder platforms, establishing common strategies and organizing both programs and future investments around agreed frameworks for results. It will be vital to further demonstrate the changes these processes are contributing to.

The development of a the new SUN Movement Strategy and Roadmap 2016–2020 will be central to achieving results, but its adoption is just the beginning of a difficult journey ahead. The Strategy will only be meaningful to the extent it is used by SUN Countries and the multiple stakeholders supporting it to become a reality.

It will be vital to build upon current successes with greater ambition for results and impact on stunting in all countries committed to scaling up nutrition. This ambition is the unique quality that has made the Movement a success. The ambition will ensure it remains country-led, inclusive, multi-stakeholder and multi-sectoral.

The tremendous energy and enthusiasm that drive the SUN Movement bodes well for the future. Nutrition is in the spotlight

– more now than ever before. The political will is growing, and the evidence is stronger than at any time in the past.

“SUN will remain country-led, inclusive, multi-stakeholder and multi-sectoral”

The SUN Movement stands for nutritional transformation. Millions of girls, women, boys and men are disadvantaged because they are needlessly malnourished. All within the movement are capable of ending this injustice. The Movement is ready to surge forward with renewed ambition and vigor. It is time to make it happen!

The countries driving the SUN Movement are at the forefront of working toward the ambitions of the 2030 Agenda for Sustainable Development. We've started together, and we can reach our destination, together.

.....
Correspondence: Tom Arnold,

SUN Movement Coordinator Ad Interim, SUN Movement Secretariat / Office of the Special Representative for Food Security and Nutrition, Dependance La Pelouse, Palais des Nations, CH-1211 Geneva 10, Switzerland

Email: tom.arnold@undp.org

Turn to page 72 to read about a Day in the Life of Tom Arnold

References

01. Reported progress from SUN Countries named above have been validated by the UNICEF, WHO, and the World Bank Joint Malnutrition Estimates group.
02. Reaching the Global Target to Reduce Stunting: How Much will it Cost and How Can We Pay for it? The World Bank, Results 4 Development, Children's Investment Fund Foundation, 1,000 Days, Bill & Melinda Gates Foundation.
03. Global Nutrition Report, 2014.

The Sustainable Development Goals

The role of ethics



Jerome Amir Singh

Centre for the AIDS Programme of Research in South Africa (CAPRISA), University of KwaZulu-Natal, Durban, South Africa and Dalla Lana School of Public Health, University of Toronto, Toronto, Canada

The Sustainable Development Goals (SDGs) were adopted by global leaders at the United Nations (UN) headquarters in September 2015. The 17 Sustainable Development Goals and 169 targets represent a bold transformational economic, social and environmental agenda relating to future international development. The SDGs set priorities and benchmarks for, among other issues, ending poverty and improving nutrition globally by 2030. Seeking to build on their predecessors, the Millennium Development Goals – which expired at the end of 2015 – the SDGs apply universally to all UN member states. However, while movement towards sustainable development, global eradication of poverty, and improved global nutrition is to be welcomed, the SDGs lack legal status and explicit enforcement mechanisms. They also add to an array of existing international nutrition-centered initiatives which, to date, have had mixed results in pursuit of their respective agendas. For the SDGs to elicit public trust and confidence, ethics must be central to their realization.

“For the SDGs to elicit public trust and confidence, ethics must be central to their realization”

The nature of the SDGs

The SDGs represent collective aspirational goals of the international community and are intended to be integrated and indivisible, global in nature, and universally applicable. Although the SDGs are grounded in human rights norms and are intended to be universally applicable, they are not a negotiated treaty. Therefore, at best, the SDGs will function as a form of “soft law”.¹ To this end, the UN is developing a global reporting mechanism that will call on countries to voluntarily submit data to track progress in light of the SDGs indicators. The UN’s high-level political forum under the auspices of the General Assembly and the Economic and Social Council will have the central role in overseeing follow-up and country review at the global level. The effective implementation of the SDGs will thus depend on a mutually supportive relationship between the SDGs and international law. Despite the need for such symbiosis, only three conventions are explicitly included in the SDGs:

1. The UN Framework Convention on Climate Change (Goal 13);
2. The Framework Convention on Tobacco Control (Target 3.a); and
3. The UN Convention on the Law of the Sea (Target 14.c).

Neither the UN Charter – which speaks about, among other issues, promoting “higher standards of living” (UN Charter Article 55a), solutions to health and related problems (UN Charter article 55b) – nor human rights instruments (including the Universal Declaration of Human Rights) have been included in the SDGs. The SDGs allude to “World Trade Organization agreements” (Target 10.a) but only in relation to special and differential treatment for developing countries. None of the 31 targets of the “justice” and “implementation” goals (Goals 16 & 17) make any reference to international law.



Outside the actual SDGs, the preceding SDGs Agenda's declaration makes reference to international instruments. This includes the UN Charter, the Convention on the Rights of the Child, the Universal Declaration of Human Rights, and "other international instruments relating to human rights." Neither the International Covenant on Civil and Political Rights nor the International Covenant on Cultural, Social and Economic Rights are referred to explicitly in any part of the Agenda. The Agenda makes only vague reference to "full respect for" and "commitment to" international law. This governance gap has led commentators to note that the SDGs "will represent a rhetorical tool that every government official and international aid worker will have to pay homage to while failing to hold accountable the appropriate actors in international development."² The lack of firm accountability and enforcement mechanisms in the SDGs raises questions about the distinction between the SDGs and similar nutrition-related aspirational frameworks which have had limited impact, to date.

.....

“The lack of firm accountability and enforcement mechanisms in the SDGs raises questions”

.....

Crowded space: SDGs and existing global nutritional initiatives

While all the SDGs are intended to be integrated and indivisible, the following SDGs are of particular relevance to health and nutrition:

- > End poverty in all its forms everywhere (Goal 1);
- > End hunger, achieve food security and improved nutrition, and promote sustainable agriculture (Goal 2);
- > Ensure healthy lives and promote well-being for all at all ages (Goal 3); and
- > Ensure availability and sustainable management of water and sanitation for all (Goal 6).

.....

“Compliance with the SDGs will depend on strong moral leadership from national authorities and sustained pressure from the international community”

.....

To achieve these goals, it will be essential to unite the global nutrition community around a common set of values, goals, and

targets. This will be challenging, given that the international nutrition arena is already a crowded space with a bewildering array of UN agencies and bodies involved in nutrition-related initiatives. These include the activities of the five UN agencies with a mandate in nutrition (FAO, IFAD, UNICEF, WFP and WHO), as well as intra-UN initiatives, such as REACH (Renewed Efforts Against Child Hunger and Undernutrition), which collectively work toward realizing the UN Global Nutrition Agenda. The UN Global Nutrition Agenda describes the vision and guiding principles for UN work on nutrition and outlines the broad aims that these five UN agencies will pursue collectively over the next five years.³ The activities of the above five agencies occur in addition to the activities of several other UN bodies, including IAEA, UNEP, UNHCR, UN Women, UNFPA, and the World Bank, which also address nutrition at the global level to some degree. The work of all these players occurs in addition to the work of the UN Standing Committee on Nutrition (UNSCN), whose mandate includes monitoring and promoting cooperation among UN agencies and partner organizations in support of community, national, regional, and international efforts to end malnutrition in all of its forms in this generation.⁴ This mandate is carried out by UNSCN Task Forces and Working Groups. Adding to the crowded international nutrition arena are the activities of the Committee on World Food Security and the World Health Assembly (WHA), the latter of which, in 2012, endorsed the comprehensive implementation plan on maternal, infant and young child nutrition, which included six global targets focusing on stunting, anemia, low birth weight, childhood overweight, breastfeeding, and wasting⁵ to be achieved by 2025, and five corresponding actions (spelt out in resolution WHA65.6).⁶ Furthermore, a Global Monitoring Framework on Maternal, Infant and Young Child Nutrition, which comprises 14 core indicators, was adopted by the WHA in May 2015.⁷ While these indicators have been aligned with corresponding SDG indicators, they will require adjustment. Similarly, to avoid duplication and redundancy, the SDG monitoring system in relation to health and nutrition must synergize with the WHA Global Monitoring Framework, as well similar monitoring initiatives, such as the UNICEF – WHO – World Bank Group joint child malnutrition estimates,⁸ the Global Nutrition Report (GNR), the Global database on the Implementation of Nutrition Action (GINA), the International Food Aid Information System (INTERFAIS), the Food Security Information Network (FSIN), and the United Nations Statistics Division's Global Indicator Database and Statistical Yearbook, which includes collated data on, among other indicators, health and nutrition. Several regional initiatives (such as the African Union's African Regional Nutrition Strategy for the period 2016–2025) and global health initiatives (such as those under the auspices of the International Food Policy Research Institute [IFPRI], Coverage Monitoring Network [CMN], Save the Children, the Scaling Up Nutrition [SUN] Movement and

the Global Alliance for Improved Nutrition [GAIN]) – are also involved in nutrition-related strategies and monitoring activities.

While synergy with concurrent health and nutrition initiatives will be key to realizing the SDGs, because of the fact that the SDGs lack an enforcement mechanism if countries fail to reach their goals or to submit data for review, compliance will largely depend on strong moral leadership on the part of national authorities and sustained pressure on the part of the international community. The failure of existing soft-law instruments to inspire nutrition-related policy reform in many settings globally – despite the open endorsement of several WHA Resolutions on

nutrition on the part of national health authorities serving on the WHA – highlight the fact that political rhetoric alone will be inadequate to realize the SDGs, and they underpin why the field of ethics must be central to realizing the SDGs.

How the field of ethics can facilitate the realization of the SDGs

Ethics, also known as moral philosophy, involves systematizing, defending, and recommending concepts of right and wrong behavior.⁹ Ethics has been described as the branch of philosophy that defines what is good for the individual and for society,

Box 1: Proposed set of ethics principles to guide decision-making in relation to achieving the Sustainable Development Goals

1. Stewardship and responsibility

Authorities, financiers, the private sector, civil society, and the public at large have a responsibility to protect and develop limited resources, and to ensure ecological integrity and human well-being. Initiatives should be implemented in a manner that most impacts on poverty reduction, ending hunger, achieving food security, improving nutrition, promoting sustainable agriculture, and improving human health.

2. Respect for persons

Authorities, financiers, the private sector, civil society, and the public at large have a duty to act responsibly and prudently towards each other, and towards future generations, in relation to resources and in respect of initiatives that most impact on poverty reduction, ending hunger, achieving food security, improving nutrition, promoting sustainable agriculture, and improving human health.

3. Non-maleficence

Authorities, financiers, the private sector, civil society, and the public at large have a moral obligation not to harm, facilitate harm, or be complicit in the harm of others in relation to initiatives that could have an impact on poverty reduction and human health.

4. Risk-benefit analysis and burden identification

The implications of initiatives that have an impact on poverty and human health must be identified in a timely manner, preferably prospectively.

5. Reasonableness and relevance

The rationale that underpins initiatives which impact, or could

impact, poverty and human health must appeal to relevant evidence, values, and principles.

6. Collaboration

Authorities, the private sector, the international community, civil society, and the public at large should engage in collaborations to mitigate the impact of initiatives that could exacerbate poverty and the adverse human health outcomes associated therewith.

7. Least harm

If an existing or proposed project or policy that actually or potentially detrimentally impacts on poverty and human health can be realized by feasible alternatives that are less adverse to poverty and human health, these alternatives ought to be pursued as a first resort.

8. Solidarity, duty of rescue, justice, and reciprocity

Humans have a moral responsibility to ensure the common welfare of humankind, particularly that of the poor and marginalized, who are experiencing or could experience detrimental health outcomes related to poverty. This necessitates providing aid and support to these individuals.

9. Transparency, publicity, and engagement

The rationales and potential health implications of existing or proposed initiatives that have an impact on, or could have an impact on, poverty and human health must be publicly disclosed and made accessible to affected stakeholders by means of meaningful engagement processes.

10. Accountability, appeal, and enforcement

Stakeholders who are being, or who stand to be, affected by initiatives that are impacting, or could impact, poverty and human health, must be given a fair opportunity to appeal against such initiatives, and to have their appeal upheld.



The panel who discussed the theme "Defining obligations and taking responsibility for stakeholder actions" at the Micronutrient Forum 2014 (left to right): Jerome Singh (UKZN), Thiago Luchesi (WVI), Purnima Menon (IFPRI), Rachel Toku-Appiah (GMT), Martin Bloem (WFP).

and establishes the nature of obligations, or duties, that people owe themselves and one another. It may be said that ethics offers a normative guidance framework on what should be done to ensure good for the individual and society, regardless of the absence or applicability of a legal obligation. Put differently, an ethical/moral duty is a duty which one owes and ought to perform, but which one is not legally bound to fulfil. Seen in this context, the omission of key international law instruments and enforcement mechanisms in the SDGs will necessitate a problem-solving mindset based on ethics¹⁰ to deliver on SDG promises. To this end, adherence to ethics norms (see Box 1) could facilitate the realization of the SDGs.¹¹

Conclusion

In the absence of legally binding compliance and accountability mechanisms, realizing the SDGs will require a mindset shift on the part of authorities – from empty political rhetoric that has generally characterized the realization of other soft-law international instruments, to a problem-solving mindset based on ad-

herence to explicit ethical benchmarks. Such an approach could help engender public trust and confidence in national authorities, transnational organizations, and soft-law instruments, and could facilitate the realization of the SDGs.

.....
Correspondence: *Jerome Amir Singh,*
Head of Ethics and Law, Center for the AIDS Programme
of Research in South Africa (CPRISA), University of
KwaZulu-Natal, Durban, South Africa
Email: *singhj9@ukzn.ac.za*

.....
Funding: *The author is supported by the Centre for the AIDS*
Programme of Research in South Africa (CAPRISA), Durban, South
Africa, which forms part of the Comprehensive International
Program on AIDS, funded by the US National Institute of Allergy
and Infectious Diseases. The author is also supported by the HIV
Prevention Trial Network. No specific funding was received for
writing this article. The funders had no role in study design, data
collection and analysis, decision to publish, or preparation of the

manuscript. The views of the writer do not necessarily reflect the views of his funders or employers.

References

01. Miller-Dawkins M. Global goals and international agreements. Lessons for the design of the Sustainable Development Goals. www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9295.pdf. Accessed October 1, 2015.
02. Wisor S. The Impending Failure of the Sustainable Development Goals. September 30, 2014. www.ethicsandinternationalaffairs.org/2014/the-impending-failure-of-the-sustainable-development-goals/. Accessed October 1, 2015.
03. McLachlan M. United Nations Global Nutrition Agenda (UNGNA v.1.0). <http://scalingupnutrition.org/wp-content/uploads/2015/06/UN-Global-Nutrition-Agenda-2015.pdf>. Accessed October 1, 2015.
04. United Nations Standing Committee on Nutrition. www.unscn.org/en/home/. Accessed October 1, 2015.
05. World Health Organization. Global Targets 2025 to improve maternal, infant and young child nutrition. www.who.int/nutrition/global-target-2025/en/. Accessed October 1, 2015.
06. World Health Assembly. WHA65/6: Comprehensive implementation plan on maternal, infant and young child nutrition, 21–26 May 2012. www.who.int/nutrition/topics/wha_65_6/en/. Accessed October 1, 2015.
07. World Health Assembly. WHA 68/9. Maternal, infant and young child nutrition. Development of the core set of indicators, 15 May 2015.
08. UNICEF – WHO – World Bank Group Joint Child Malnutrition Estimates Group. Levels and trends in child malnutrition. Key findings of the 2015 edition. www.who.int/nutgrowthdb/jme_brochure2015.pdf?ua=1. Accessed October 1, 2015.
09. Fieser J. Ethics. www.iep.utm.edu/ethics/. Accessed October 1, 2015.
10. United Nations University. Jeffrey Sachs: Achieving the SDGs is a Matter of Ethical Mindset, Not Economics. August 4, 2015. <http://portal.unu.edu/calendar/?go=event.page&id=10001>. Accessed October 1, 2015.
11. Singh JA. Why human health and health ethics must be central to climate change deliberations. *PLoS Med* 2012 9(6): e1001229. doi:10.1371/journal.pmed.1001229

Back to the Future with the Global Goals

Why and how agriculture can return to its nutrition roots

Howarth Bouis

HarvestPlus, Washington DC, USA

Why do we have agriculture? When addressing audiences of agricultural policy-makers, I sometimes begin by asking the group to raise their hands and vote for what is more important to them personally: their health or their income? Ninety-nine percent, of course, quickly indicate that their health is more important to them than their income. Then I ask them: In your profession, if you were Minister (even Dictator) of Agriculture, what would drive your decisions – the role of agriculture to provide incomes and jobs, or the role of agriculture to provide food to eat, and so adequate nutrition, and so a healthy nation? There is some hesitation (I presume due to their answer to the first question), but 80 percent vote for incomes and jobs, and the remaining 20 percent appear confused; many do not vote at all.

**“Dietary quality is further and further
out of reach for the poor”**

The Green Revolution some decades ago, while impressively raising productivity in response to rapid population growth, focused on a few key food staples (rice, wheat, maize). Advances in agriculture have helped the world become increasingly food secure, but there was no equivalent focus to increase the productivity of the range of non-staple foods such as vegetables, fruits, pulses, fish, and animal products, which are dense in minerals and vitamins. Consequently, the prices of food staples are 20 percent lower today than they were 50 years ago, while the prices of non-staple foods have more than doubled and continue to rise. Dietary quality is further and further out of reach for the poor.

**Agriculture’s failure to supply
a micronutrient-rich diet for the poor**

It is important to keep the above context in mind when apprais-

ing the Millennium Development Goals (MDGs). The goal of direct relevance to the nutrition and agriculture communities was Goal 1, which sought to “Eradicate extreme poverty and hunger.” Its scorecard shows impressive results; the number of people living in extreme poverty declined by more than half (1.9 billion in 1990 to 836 million in 2015), and the proportion of undernourished people in developing countries dropped by almost half (23.3 per cent in 1990–1992 to 12.9 per cent in 2014–2016). But it’s obvious that the Goal defined hunger and nourishment based on dietary energy consumption. In so doing, it unwittingly limited agriculture’s role to providing quantity and not more minerals and vitamins in diets. The reduction in that narrowly defined “undernourishment” is impressive, but what do we make of the fact that at the conclusion of the MDGs some 2 billion people – largely from the developing world – are suffering from hidden hunger caused by lack of vitamins and minerals in their diet? Almost half a million children, for example, lose their eyesight each year due to vitamin A deficiency. Women who lack adequate iron in their diets are at greater risk of pregnancy-related complications and maternal death.

The global prevalence of hidden hunger is, for the most part, due to the failure of agriculture to provide an adequate supply of minerals and vitamins to poor or low-income families that rely on staple foods for daily sustenance. But, even where the non-staple foods necessary for a mixed diet are available, they are often unaffordable to these families in adequate amounts or, if grown, to make some income.

**Increased awareness of the links between
agriculture and nutrition**

Fortunately, there is greater awareness now of the links between agriculture and nutrition, in part due to the global staple food price shocks in 2007–2008, which grabbed the attention of world leaders and triggered greater investment by donors, including President Obama’s Feed the Future Initiative. Agriculture’s most fundamental purpose is to nourish people, and well-nourished people are more likely to be healthy and productive. It will require a joint effort between nutrition-smart agricultural



Iron-rich pearl millet in India can provide consumers with up to 80% of their daily iron needs.

interventions and policies, and direct nutrition interventions such as supplementation and fortification, to eliminate malnutrition for all socioeconomic groups.

.....

“Agriculture’s most fundamental purpose is to nourish people”

.....

The newly adopted Sustainable Development Goals (SDGs) – more commonly referred to as the Global Goals – are even more ambitious and integrated than the MDGs. Their overarching focus is on creating opportunities for the poor by improving health, education and livelihoods. We at HarvestPlus are particularly excited about Goal 2, which seeks to “end hunger, achieve food security and improved nutrition, and promote sustainable agriculture.” The inclusion of both nutrition and agriculture is appropriate and necessary.

Goal 2 calls for access to “safe, nutritious and sufficient food all year round,” with indicators on reducing stunting and wasting, and meeting the nutritional needs of vulnerable populations. There are many ways that agriculture can contribute to better diets – for example, homestead gardening driven by behavior change through nutrition education, and stemming the increases in prices of non-staple foods by improving productivity through agricultural research and by reducing bottlenecks in the marketing value chain.

HarvestPlus: at the confluence of agriculture, nutrition, and public health

At HarvestPlus, we work at the confluence of agriculture, nutrition, and public health, and have long advocated closer linkages between these three sectors. Biofortification is the process of developing, through plant breeding, staple food crops that are rich in vitamins and minerals. Nutritious staple food crops are rich

in zinc, iron or vitamin A – micronutrients that can respectively reduce stunting, build brains, and strengthen immune systems in children, laying the groundwork for a healthy and productive society. Because they are high-yielding, biofortified varieties sell for the same price as non-biofortified varieties. Therefore, the extra minerals and vitamins come for free to farmers and consumers when a biofortified variety is grown/purchased and substituted one-for-one for a non-biofortified variety.

“Biofortification actualizes and strengthens agriculture’s nutritional purpose”

Biofortification, which actualizes and strengthens agriculture’s nutritional purpose, aligns well with the Global Goals. Biofortification was in its infancy when the MDGs were established, but more nutritious varieties of staple food crops are now being grown by millions of smallholder farm families in Africa, Asia and Latin America. Biofortification is poised to scale up to reach a billion vulnerable people by 2030 – the same target date as for the culmination of the Global Goals.

“Leaving no one behind”

A key theme of the Goals is “leaving no one behind.” Biofortification targets smallholder farmers with limited access to other nutritional interventions. We recognize that urbanization continues to grow, and our goal is for biofortified staples to reach urban dwellers, but our primary focus now is on the majority of people in developing countries who subsist on the food that they grow on small plots of land in rural areas. By providing them with important micronutrients through the food crops on which they rely for daily sustenance, biofortification ensures that such rural, largely poor, populations are not left behind in the effort to improve nutrition and public health nationally and globally.

What evidence is there to show that biofortification actually improves nutrition and public health? It bears emphasizing that biofortification is new to the quiver of nutrition interventions. The first biofortified crop, vitamin A rich orange sweet potato (OSP) is being scaled up across African countries to reach millions of people. Early pilots and research studies have shown that farmers are willing to adopt and eat OSP, and that it leads to increases in vitamin A intake in infants, children and women. Children in Mozambique who ate OSP were found to be less likely to suffer from diarrhea. If they happened to contract the disease, they were found to suffer it for a shorter duration than children who did not eat OSP. We already know from other studies that vitamin A supplementation reduces the incidence of diarrhea in children, particularly the undernourished or those suffering

from severe infections. This is the first research to show that an agricultural food-based approach can have a similar effect in young children.

In India, researchers found that biofortified pearl millet bred to be richer in iron reversed iron deficiency in school-aged children within six months. In just four months, it improved iron levels significantly. Previous research had found that the same iron-rich pearl millet provided iron-deficient Indian children under the age of 3 with enough iron to meet their daily needs. Both the OSP and iron pearl millet studies were peer-reviewed and published in leading scientific journals. Similar evidence on efficacy of orange maize rich in vitamin A has also been published.

“Agriculture can make important contributions to other Global Goals”

Biofortification clearly belongs under Goal 2, but it and, by extension, agriculture can make important contributions to other Global Goals. As noted earlier, by providing a child with the nutrients essential for physical and cognitive development, biofortified crops help to improve the child’s health (Goal 3) and capacity for learning (Goal 4). For adults, a healthier life from consuming more nutritious food means greater economic productivity (Goal 8).

Biofortification also reinforces the goal of maintaining the genetic diversity of seeds, plants and animals (Goal 15), since



Young children in Uganda get a valuable dose of vitamin A by eating orange sweet potato.

it depends on the existing genetic diversity of seeds to develop nutrient-rich crop varieties. Without the diversity in the gene banks established by our CGIAR partner institutes, scientists would never have been able to conventionally breed for higher micronutrient content in our staple crops.

In addition to being more nutritious, biofortified crops boast other benefits over traditional varieties. They are high-yielding, and tolerant to threats such as viruses, diseases, heat, and drought. In other words, biofortified crops are not only nutrition-smart, they are also climate-smart (Goal 13). This means they put less stress on land and water resources compared with their non-biofortified counterparts (Goal 12).

Our programs in target countries are increasingly building and supporting markets for biofortified crops. While our primary focus remains rural, subsistence smallholder farmers, we know that these farmers usually sell any extra harvests in order to earn some income. For the same reason – higher yields and attendant earning potential – commercial farmers are increasingly attracted to biofortified crops. It makes sense, therefore, to stimulate and strengthen the market for biofortified crops, so that farmers maximize their earning potential, improve their livelihoods, and fight poverty (Goal 1).

In the majority of countries where biofortified crops have been released, women are the meal managers and are, therefore, key to improving household nutrition. Our program purposely

targets women and empowers them with knowledge on best farming, feeding, and hygiene practices to improve their own health and that of their households (Goal 5). A woman’s education has trickle-down effects not only on her immediate family, but also ultimately on the community as a whole.

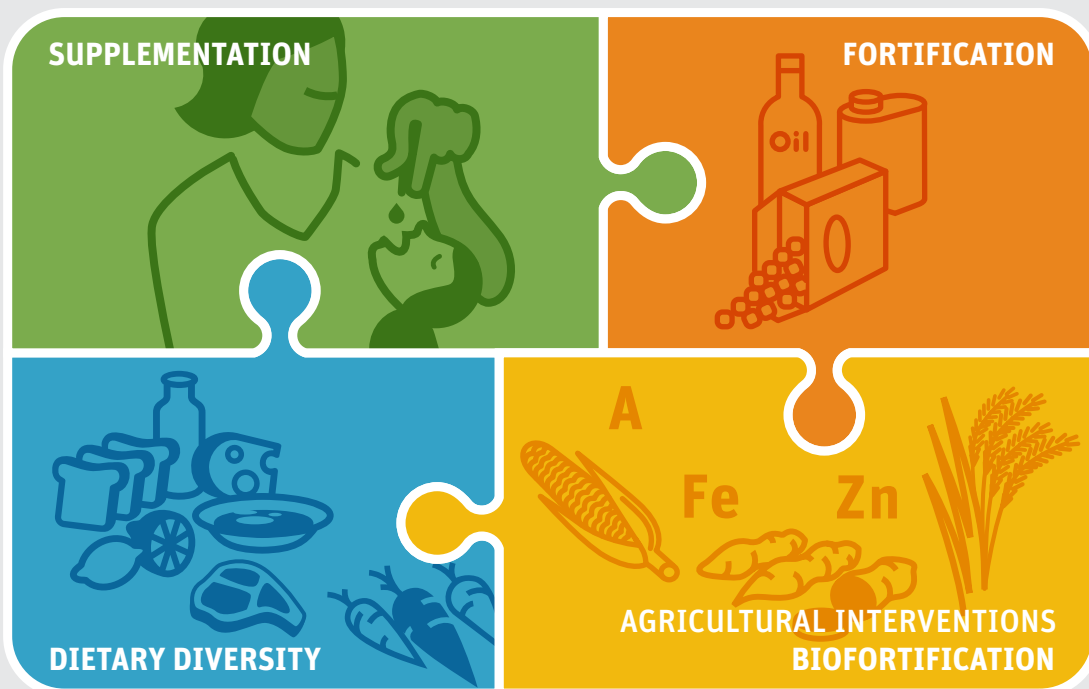
Biofortification provides a template for success

Biofortification’s success in contributing to the realization of the Global Goals will equally be agriculture’s. So, what will it take to succeed? Multi-stakeholder partnerships and inter-disciplinary collaboration. By strengthening the linkages between agriculture, nutrition, and public health, biofortification provides a template that other sectors and disciplines involved in the SDGs could draw from. Biofortification is also a good example of how a broad array of stakeholders – including researchers, multilateral institutions, business, NGOs, and farmers – can work together toward an important development goal. Without effective linkages and partnerships, HarvestPlus will not be able to achieve its goal (reaching 1 billion people with biofortified nutritious foods by 2030); neither will the Global Goals.

Correspondence: Howarth Bouis,

Director, HarvestPlus, c/o IFPRI, 2033 K Street, NW, Washington, DC 20006-1002, USA Email: h.bouis@cgiar.org

The Various Approaches to Bridge the Micronutrient Gap.



Getting Locals to Eat more Vegetables in Mozambique



The Veg Shop sells fresh agricultural produce.

Bonnie McClafferty

Agriculture for Nutrition Program
Global Alliance for Improved Nutrition,
Washington DC, USA

On some days, tomatoes can be scarce in the city of Chimoio, central Mozambique. Prices might go up, and then fall again the next day. The same is true for other staples: onions, green peppers and so on.

It's an erratic market, because all the small-scale vendors who make up this marketplace rely on supply trucks coming into the city from distant farms, and whatever they bring that day. Those trucks might not show up some days, which is why the local market for consumers can be volatile. The product variety can also be limited.

But one farmer, located just about 10 km outside the city, is now changing that. Kota Benade, originally from Zimbabwe, has a 12 hectare plot there along a river, where he grows not just tomatoes but also spinach, sweet potato, beetroot, pumpkins, and bananas. Only a few years ago, beetroot was virtually unknown here.

The real difference Benade is making, however, is through the introduction of a farm shop on the side of the main road into town, where he sells both wholesale and retail.

Thanks to that shop – which opened last week, after an existing structure was knocked down and rebuilt into a modern facility – Chimoio's small-scale vendors no longer have to rely on whatever comes into town. Instead, they can hop on one of the many shapas (minibuses) that ply this main stretch of road, pay their fare of 7 Meticals (US\$0.01), and visit this convenient, reliable wholesale supplier.

"It's five minutes away," says Benade. "They can come here, get 50 cabbages, and be back at their stall and selling by 7 am. Otherwise, they have to wait for the big trucks to bring produce into the central market."

The impact of this is not just about making life more convenient for vendors. Benade describes the local vegetable production market as "scattered and disorganized," and by providing a steady, varied supply close to town, end consumers will benefit from a wider range of vegetables at lower prices. This, in turn, improves their diet and nutrition.

"It will be a continuous supply of good quality produce, and because we're so near we can sell at a lower wholesale price, and vendors can buy at a lower price and pass that on."

**"It will be a continuous supply
of good quality produce"**

The farm shop’s location happens to be a place where the shapas routinely stop anyway. Benade has therefore included a retail section in the shop too, so that not just the small-scale vendors but also other people travelling into and out of Chimoio can buy something to take home for dinner.

“Commuters can do a quick shop here,” he explains. “They’ll know it’s here, so they can stop and grab a bagful of fresh vegetables on the way home.”

GAIN has supported Benade in the building of the shop, as well as upgrading his own farm with electricity to power his irrigation, and a vehicle to move produce between the farm and shop. But ask him what his biggest headache is, and the answer is simple: bureaucracy.

More than half a year after installing electricity lines on his farm, Benade is still waiting for the local electricity supplier to connect him to the grid.

“It’s a two-hour job for them, and once I have electricity I’ll be able to pump water with ten times the efficiency,” he says.

Relying on diesel engines to power his irrigation system means the crops just don’t get as much water as they could. Each engine can only run for a few hours a day before it overheats, and they tend to break down regularly too.

“Just recently I had to spend another 35,000 Meticals (US\$775) on a new one. When I’ve got crops in the ground, I can’t afford not to water them.”

Tomatoes need plenty of water, and the cost of not having electricity is clear to see on the farm. Jordão, one of Benades’

farm workers, showed us a field where the crop hadn’t been watered enough. Next to it, some luckier tomatoes looked much healthier.

“The good ones sell for 800 Meticals (US\$17.50) a box,” Jordão told us. “The bad ones, 600 Meticals (US\$13.25).”

These problems will hopefully soon be a thing of the past. With electricity on the farm, Benade will be irrigating 24 hours a day and ensuring a consistent supply and quality of fresh fruits and vegetables. He expects to spend the next couple of years developing the farm shop in Chimoio, but has his sights set on other areas of Mozambique too.

.....
“With electricity on the farm, Benade will be irrigating 24 hours a day”
.....

“The market has been undersupplied and disorganized for years,” he says. “But people really want good quality produce here. Demand is growing for the crops I’m selling, which were unknown before – like beetroot, and even spinach. With this model, the small vendors will do better business, I’ll do better business, and local families will have a better diet.”

.....
Correspondence: *Bonnie McClafferty, Director, Agriculture for Nutrition Program Global Alliance for Improved Nutrition, 729 15th Street, NW, Washington DC 20005*
Email: bmcclafferty@gainhealth.org



“People really want good quality produce here.”

D John Shaw (1934–2015)

“WFP’s Licensed Intellectual”

John Shaw, the economist and author, who died in August at the age of 81, was a member of the Editorial Board of the journal *Food Policy* for over 30 years. *Food Policy* was launched in the wake of a global crisis and following the World Food Conference of 1974.

John’s career was largely within the UN and included a late post-retirement flowering, which resulted in a series of authoritative books on international development and the history of the United Nations. For thirty years before that, he was at the heart of global policy-making in successive roles at the UN World Food Programme (WFP), latterly as Head of Policy Affairs.

John Shaw joined the fledgling WFP in 1963. WFP’s remit was to pioneer uses of food aid through the UN system, complementing programmes by other donors, especially the USA. In an era of global food surpluses, WFP was to receive donations of food and use them for school feeding or food for work projects. The multilateral dimension was important. US food aid had rightly been criticized for being used as a political tool, favoring friends and punishing enemies. The WFP, jointly managed by the UN in New York and the FAO in Rome, but overseen by UN Member States, was to be more neutral, transparent and accountable.

A living embodiment of the WFP’s institutional memory

Working in evaluation, then in policy, from early on as WFP’s licensed intellectual, and eventually as a living embodiment of the institutional memory, John Shaw supported successive Executive Directors, and helped steer WFP through momentous changes.

As the use of food aid changed, it was also important for WFP to become more professional and better governed. The case had to be made repeatedly – and John Shaw made it. His policy papers were forward-looking and policy-relevant, respectful of history and fluently written. Many would have suc-

cumbed to the apparent drudgery, but John Shaw flourished. He was relentlessly optimistic, urbane and engaged, endlessly excited by new ideas.

“His policy papers were forward-looking and policy-relevant, respectful of history and fluently written”

In 1994, John Shaw moved into nominal retirement, partly in London, partly in Houston, but actually probably mostly in the Library of Congress. He wrote academic articles and volumes of papers, but will be remembered principally for three big books.

The first of these, published in 2002, was a biography of Professor Sir Hans Singer, the eminent and much-loved development economist, refugee from Germany, student of Keynes, and one of the first economists appointed to the UN.¹ The second book, published in 2007, was a history of world efforts since 1945 to achieve food security.² The final book, published in 2011, was a history of WFP as a humanitarian donor.³

The humanitarian sector continues to evolve, as will be seen at the World Humanitarian Summit in 2016. The core principles established by Henri Dunant following his experience on the battle field of Solferino in 1859 still hold: neutrality, impartiality and humanity are the keystones of humanitarian principles and law. WFP has been part of this revolution.

John Shaw was married to Ileana for 56 years. Ileana died just weeks after John himself. He is survived by two children, Elizabeth and David, and a grandson, Christopher.

Correspondence: *Simon Maxwell CBE,*
20 West Drive, Queens Park, Brighton BN2 0GD, UK
Email: sm@simonmaxwell.eu



D John Shaw (right) celebrating his milestone publication *World Food Security* – in the words of the publisher Palgrave Macmillan, “the first comprehensive history of the numerous attempts made since the Second World War to provide food security for all”.

References

01. Shaw DJ. *Sir Hans Singer: The Life and Work of a Development Economist*. Palgrave Macmillan, 2002. ISBN 9780333711309.
02. Shaw DJ. *World Food Security: A History since 1945*. Palgrave Macmillan, 2007. ISBN 9780230553552.
03. Shaw DJ. *The World's Largest Humanitarian Agency: The Transformation of the UN World Food Programme and of Food Aid*. Palgrave Macmillan, 2011. ISBN 97802308732, which in particular updates his earlier 2001 *UN World Food Programme and the Development of Food Aid*, Palgrave Macmillan.

This appreciation of John Shaw was drafted by Simon Maxwell with contributions from Sir Richard Jolly, Richard Longhurst and Edward J Clay. It is published here in abridged form [Ed.].

A Day in the Life of Tom Arnold

Tom Arnold holds a number of highly influential roles – as Director General of the Institute of International and European Affairs (IIEA), Ireland’s leading think tank; Special Representative for Hunger, Concern Worldwide, Ireland; and ad interim Coordinator of the Scaling Up Nutrition (SUN) Movement. He discusses the many roles and responsibilities that have gone into an international career that shows no signs of stopping.

Sight and Life (S&L): *Tom, you currently hold more than one very senior position. If we start first with your role with SUN, what brought you to this position?*

Tom Arnold (TA): I’ve been involved with SUN ever since it was launched by US Secretary of State Hillary Clinton and Irish Foreign Minister Micheál Martin in 2010, when I was still Chief Executive of Concern Worldwide. In that capacity, I was appointed to the SUN Lead Group in April 2012. The Lead Group’s initial term of office was for two years, but this was subsequently extended until the end of 2015. In August of 2014, when the Ebola crisis had reached a very significant pitch, SUN Coordinator David Nabarro was requested by the UN Secretary General to coordinate the United Nations’ response to it. The demands of this new commitment made it impossible for David to continue as SUN Coordinator, so he and Tony Lake, the Chair of the SUN Lead Group, asked me to step into the breach for six months. At the end of that period, I was asked to serve for another six months. By that time, it had been decided to look for a longer-term replacement for David, and so I will be continuing in my present position until that person has been appointed.

S&L: *Until recently you were CEO of Concern Worldwide. You now occupy the position of Special Representative for Hunger for that organization. How has your relationship with Concern Worldwide evolved over the years, and to what extent does it inform your current work for the SUN?*

TA: Concern Worldwide has been a big part of my life; I joined its Board in the 1980s, and was appointed Chief Executive in 2001, remaining in that role until February 2013, when I stepped down. During that period, Concern Worldwide continued to be a leading humanitarian organization, responding to crises all around the world. It also began to carve out a substantial role in the field of nutrition, pioneering the treatment of severe acute malnutrition (SAM) in close collaboration with Valid International. This approach gained acceptance among the global nutrition community, and Community Management of Acute Malnutrition (CMAM) was introduced in 2007 and established itself as the recognized standard. Concern’s activities in the area of stunting were also significant. So when I stepped down as Chief Executive, Dominic MacSorley and the Board asked me to take on the role as Special Representative for Concern. So I keep up to date with all of Concern’s activities, and especially its pioneering work, and I reference these efforts when speaking on nutrition, as I am often called on to do. Concern also works very closely with The International Food Policy Research Institute (IFPRI), and this collaboration has really helped Concern to translate its findings into effective policy proposals that have an influence far beyond its own scope of activity. We were also fortunate at the time to have the financial support of Kerry Group, Ireland’s leading food company. I always thought that combining the capabilities of a leading think tank and a leading private sector organization in this fashion was the right way to progress the nutrition agenda – and that’s a message that I still communicate as Special Representative for Concern.

“I always thought that combining the capabilities of a leading think tank and a leading private sector organization was the right way to progress the nutrition agenda”





Tom Arnold (left) with Mary Robinson (President of Ireland 1990–97), Ban Ki-moon (UN Secretary-General), and Charles Flanagan (Irish Minister for Foreign Affairs and Trade), at a speech given by Ban Ki-moon in Dublin Castle at an event titled “The UN at 70: Looking Back, Looking Forward”, May 25, 2015

S&L: *And your role as Director General of the Institute of International and European Affairs?*

TA: IIEA’s role is to advise on Ireland’s relationship with the European Union and the rest of the world, focusing on key themes such as security, climate change and the digital economy. Our role is to deliver high-quality thinking that might inform policy; at the moment, for instance, we’re analyzing what might happen if Britain were to leave the EU.

S&L: *Going back to the subject of the SUN Movement, Tom, what do you think it has achieved in the past five years?*

TA: I think SUN has done a great deal to highlight the political importance of nutrition. A lot of the world’s political leaders are now beginning to appreciate the significance of nutrition for the current and long-term welfare of their people, as well as for their prospects of economic growth. This new understanding is encouraging the introduction of policies that begin to tackle the problem of undernutrition in particular. To give you an idea of the scale of the problem, the average level of stunting across the 15 southern African states is 39%. This is a frightening problem, and requires very serious attention. On a more practical level, the SUN Movement now numbers 56 countries, plus the Indian state of Maharashtra, and member countries are increasingly pooling their experience and sharing best practice. SUN is creating opportunities for this thinking to be shared, focusing on topics such as attracting the necessary resources and building the required capacity. We hold global meetings, and these are real hothouses for learning, generating enormous enthusiasm and commitment.

S&L: *So how do you think SUN will develop in the next five years?*

TA: I and others have spent a lot of time in 2015 thinking about precisely that question! We’ve developed a strategy which was endorsed by the SUN Lead Group in September 2015 and will become effective as of January 2016. The first five years of the SUN Movement were spent getting people working together across borders in a really effective manner. Our focus for the next five years will be very much on implementation, achieving results, and obtaining more resources for nutrition. We’ll also be trying to ensure that nutrition spend, whether direct or indirect, achieves more. So we’ll be trying to support better outcomes, whether the interventions in question are nutrition-specific or nutrition-sensitive.

S&L: *Looking back over your five years to date with the SUN, has there been a defining moment for you?*

TA: I think back to the Global Gathering in Rome in November 2014, which brought together some 300 people for a three-day period in the run-up to the second International Conference on Nutrition (ICN2). I thought the exchanges between participants were very significant, because people were standing up and showing what they had achieved in their own countries, and others were asking them detailed questions about how they had managed to do these things. It’s not about new ideas as such: it’s about doing a few things well, and doing them collectively – ensuring, for instance, that appropriate sanitation is in place, providing the conditions that are conducive to good nutrition. In the longer term, I think it’s crucial that women’s voices should be heard and that they should help to formulate nutrition policy and shape nutrition programs going forward.

“SUN is not about new ideas as such: it’s about doing a few things well, and doing them collectively”

S&L: *In October 2012 you were appointed Chairperson of the Convention on the Irish Constitution. Can you tell us a little about this role? Why is a Convention on the Irish Constitution necessary, what does it aim to achieve, and how does it operate?*

TA: The Irish Constitution dates from 1937, and there was a growing feeling in Irish political circles that aspects of it could benefit from a review. After the general election of 2011, therefore, it was decided to reconsider and possibly revise certain elements, subject to a referendum on these subjects. A Convention consisting of 100 people was therefore created, compris-

ing two thirds citizens and one third politicians and reflecting the overall composition of the Irish population. I was invited to chair this Convention, which was tasked with considering eight aspects of the Constitution during the course of a year. It was a great honor to be asked, and I couldn't say no! We met during the weekends and voted on each subject after a weekend of discussion and debate. We enjoyed a certain amount of latitude, and added a further two topics, completing our conclusions after 14 months. Of the recommendations we made, the one that has so far led to constitutional and legal change concerns same-sex marriage, which was barred under the terms of the 1937 Constitution. We also examined topics such as the voting age and the role of women in society. It was an excellent experiment in direct democracy and has attracted a lot of interest among political scientists worldwide; an academic book on the subject is currently in preparation, in fact. Not a lot of the recommendations of the Convention have been enacted yet, but this may change when the next Irish government is voted into office.

S&L: *Moving on from that example of direct democracy, Tom, can we discuss good governance in the nutrition space? What are the prerequisites for good nutrition governance at a global level, in your view?*

TA: A fundamental principle of SUN is that of mutual accountability. The SUN Movement has many stakeholders, but they have to account to one another for their decisions and actions – and of course, their actions can only be implemented with the help of many hands. What SUN is doing very successfully now is to bring its many stakeholders together in a structured way that facilitates concerted and effective action. Returning to the Convention for a moment, one of the things that impressed me most about it was the degree to which the citizens in it took on their responsibilities. I'm a great believer in the two great political principles that all politics is local and that people like to be consulted. If you engage with people properly and make them feel that they have a role in the overall process and a responsibility to discharge that role, they will usually rise to the occasion.

“I'm a great believer in the two great political principles that all politics is local and that people like to be consulted”

S&L: *You have held many illustrious positions besides those already discussed – Assistant Secretary General and Chief Economist in the Department of Agriculture*

and Food in Ireland, Chairman of the OECD Committee of Agriculture, Chairperson of the Irish Times Trust and Director of the Irish Times, to name but a few. Is there a common thread that runs through all these appointments?

TA: One factor was certainly being in the right place at the right time, and another was always pursuing opportunities that interested me. At the beginning of my career I was deeply interested in Ireland's relationship with Europe, and I graduated from university just at the time when Ireland was joining the European Economic Community (EEC), as it was in those days. I was fortunate in being offered a role with the European Commission at a very exciting time. I was also extremely interested in developing countries, and I hoped as a student to have the opportunity to work in development overseas. At an early stage in my career I spent three years in Africa, later working in Brussels on matters relating to Africa. Then comes my interest in agriculture. I grew up on a farm and studied agricultural economics at university. And so I've been working in these three interrelated areas of Europe, the developing world, and agriculture all my life. I've never really had a career plan as such; I've just been extremely fortunate, and I've always followed the simple principle of trying to do whatever I do as well as I possibly can. I'm a firm believer that if you do that, your career will find a way of looking after itself. So I've been enormously fortunate, and I've also been blessed in having a very happy family life.

S&L: *You are known as a powerful advocate of better nutrition for poor and vulnerable populations worldwide. What is the secret of effective advocacy, in your view?*

TA: I think it's essential to care deeply about whatever it is you're advocating. There's a saying that “If you can fake sincerity, you've got it made,” but I don't think that you can really fake sincerity and get away with it. Either you believe in something or you don't. I didn't go into Concern with the sense that I was going to spend a lot of my career as an advocate. There was, however, a growing interest in nutrition at the time, and I felt that Concern had something important to say that was grounded in this reality. We had valuable evidence, but the second part of the challenge was the question of how to deploy this evidence to maximum effect – which involves knowing who the key players are and how to influence them. Learning these things is an essential part of becoming an effective advocate.

S&L: *The Irish are famous for their love of poetry, and for the many great poets they have produced. Is there an Irish writer who inspires you particularly, or a work of literature that has had a special influence in your life, Tom?*

TA: One of the best-known Irish poets of recent times was Seamus Heaney, who died two years ago. He was truly remarkable. One of the most notable things about him was his generosity of spirit – he had a great natural grace about him, and he always had time for people. I often think of one of his early poems, *Digging*, which was published in 1965. It was a clear statement of intent: writing poetry was what he wanted to do with his life. The poem is about watching his hard-working father digging turf with a spade. The poem concludes with the lines: “Between my finger and thumb / The squat pens rests. / I’ll dig with it.” His evolution as a poet was quite remarkable, and included an intense exploration of the work of various writers from the past and a range of mythic subjects. He carved his own way, that is to say, and he left behind an oeuvre that was complex in terms of its content but also extremely accessible. Heaney has always inspired me.

S&L: *With so many different roles and responsibilities in your professional life, you must be very good at managing your time. What are your working days like? Is there such a thing as a “typical” working day for you, or is every day different?*

TA: I certainly don’t have a “typical” working day. I travel a great deal, attending many conferences, and I’ve always tended to have more than one role at any one time. Essentially it’s a question of managing your time efficiently. But I certainly believe that you cannot do any job successfully unless you prepare for it properly, so preparation has always been extremely important to me. This is especially the case with chairing meetings. To an extent this is a learned skill, of course, but things go much better if you make the time to really prepare yourself well.

S&L: *If you look back over your career to date and could change one thing about it, what would it be?*

TA: I’ve been very fortunate in being able to pursue many interests – working in overseas development, the civil service and also the NGO space. So I’ve done many things that I’ve wanted to do, even if I hadn’t actually planned to do them. One area in which it would have been interesting to work is the private sector, if I had been able to find the time for it. I have no regrets, though, and I’m very thankful for the opportunities that I’ve been given.

.....

“It’s essential that nutritionists should build on the work of recent years and ensure that their voice continues to grow”

.....

S&L: *If you could change one thing about the nutrition community as a whole to make it more effective today, what would that be?*

.....

TA: If we look back seven or eight years, the nutrition community used to be really very disjointed. It was sometimes referred to as an “institutional orphan,” in fact, because it didn’t really “belong” within national bureaucracies. This is changing through the work of the SUN. The nutrition community has really come together in the past few years to agree core agendas, and national bureaucracies have started to realize that they have to take account of nutrition. There will always be diverse approaches at national bureaucratic level, and there will always be differences of opinion within the nutrition community, of course, but it’s essential that nutritionists should build on the excellent work of recent years and ensure that their voice continues to grow and that their views are taken seriously.

S&L: *How do you relax from work, and what are your interests outside the professional sphere?*

.....

TA: Watching sport when I get the time is very important for me, as is reading. I possess a large number of books that I hope to be able to read some day ... I also try to keep fit, and enjoy playing tennis – although it’s difficult to fit it in with all the travelling. I enjoy going to the theatre as well. But I haven’t managed to retire yet, and I’m unlikely to do so as long as people keep asking me to do interesting things, so my spare time is still very limited!

S&L: *Tom, thank you very much for your time, and all the best with your current and future work.*

.....

TA: Thank you, Jonathan.

.....

Tom Arnold was interviewed by Jonathan Steffen

.....

8

DECENT WORK AND ECONOMIC GROWTH

.....
0.9% of GDP is lost to
iron deficiency alone
.....



Anemia in Children Under 5 Years of Age in Cameroon

A silent burden at the core of a rural-urban rivalry

Jonas Tchassem Pinlap

Institut de Formation et de Recherche Démographique [Institute for Demographic Training and Research] (IFORD), and Ministère de l'Économie, Planification et Aménagement du Territoire [Ministry of Economics, Planning, and Land Use] (MINEPAT), Yaoundé, Cameroon

Investigating the prevalence of anemia among children in Cameroon

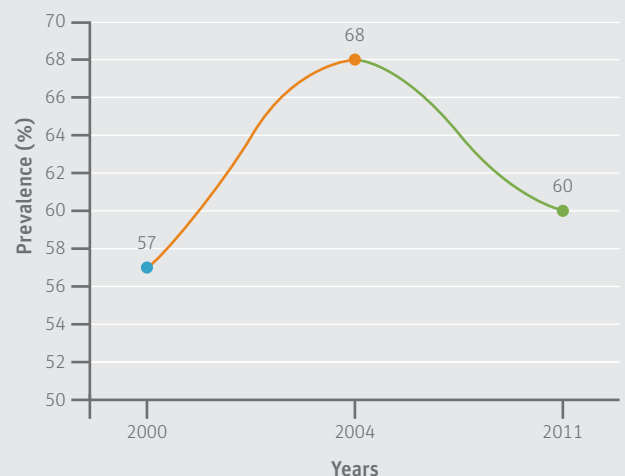
As in most developing countries, anemia is a significant public health concern in Cameroon. Its prevalence is well above the 40% threshold established by the World Health Organization (WHO) above which anemia is considered severe. More than three out of five children under 5 years of age are anemic, predominantly in rural areas (64.4%). The goal of our study is to add to the store of knowledge about the factors that explain the high prevalence of anemia among children in Cameroon.

“Anemia is a significant public health concern in Cameroon”

The history of anemia in Cameroon

A national survey of vitamin A deficiency and anemia was conducted in Cameroon in 2000. The survey indicated that 57% of children from 1 to 5 years of age and 53% of pregnant women were anemic. These findings led the government of Cameroon to

FIGURE 1: Trend of the prevalence of anemia among children from 6 to 59 months of age in Cameroon between 2000 and 2011.



Source: Jonas Tchassem Pinlap. Based on EDS 2004 and EDS-MICS 2011 data.

set a goal of achieving a one-third reduction in the prevalence of anemia among children and women of childbearing age by the year 2011.

The Demographic and Health Survey conducted in the year 2004 included anemia tests for children. This survey detected a prevalence of 68% among children from 6 to 59 months of age at the national level, with a somewhat higher prevalence in rural

areas (71.6%) than in urban areas (63.6%). More recently, in the year 2011 the results of the fourth Demographic and Health Survey indicated that three out of five children between 6 and 59 months of age are anemic, viz. 64.4% in rural areas and 57.2% in urban areas (Figure 1 and 2).

Accordingly, despite a downward trend between 2004 and 2011, the goal that had been set in the year 2000 was not achieved. Instead, the overall prevalence of anemia increased during the period from 2000 to 2011, despite numerous efforts to reduce it.

Study data and methods

Our study was based on a secondary analysis of cross-sectional data. The data consisted of the findings of the EDS-MICS¹ survey performed in Cameroon in 2011 on a sample base consisting of 4,566 children between 6 and 59 months of age who actually underwent hemoglobin testing during the survey. The prevalence of anemia based on hemoglobin levels was adjusted as a function of altitude, using the 1998 CDC² formulas.

Profile of anemic Cameroonian children between 6 and 59 months of age, by place of residence

As shown in Figure 2, more than three out of five Cameroonian children between 6 and 59 months of age have anemia. In terms of their place of residence, children in rural areas are more heavily affected than their counterparts in urban areas. This difference is statistically significant at the 5% threshold.

These children lived in the northern Sudano-Sahelian region, in households with at least three children under 5 years of age. They were male, between 6 and 23 months of age, emaciated, and unvaccinated. They had also been ill during the two-week period that preceded the study. Their mothers were uneducated, were unemployed or housewives, were anemic themselves, and were young when their children were born.

Principal risk factors for anemia in children under 5 years of age

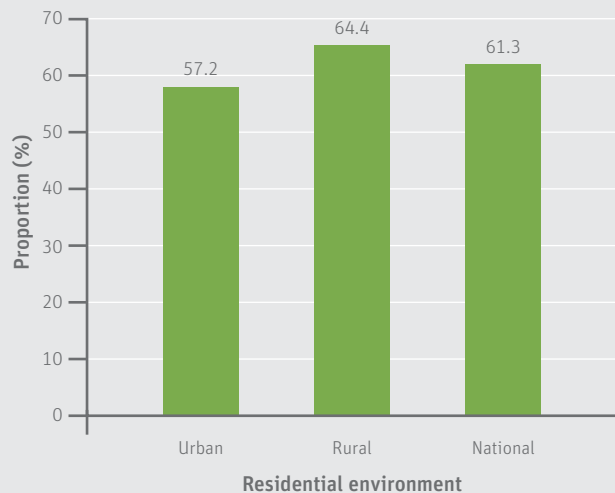
1) Age

Age is an important explanatory factor for anemia. Children under the age of 24 months living in cities and towns in Cameroon have a 2.6 times greater risk of being anemic than do children 24 months of age and older. In the countryside, this risk is 2.4 times higher.

2) Residential region

The residential region is a discriminant variable for pediatric anemia. In Cameroon it may be due, on the one hand, to the difference in the altitude of the residential regions and, on the other hand, to diet and to the presence of sanitation facilities.

FIGURE 2: Proportion of anemic children between 6 and 59 months of age, by residence



Source: Based on the EDS-MICS 2011 data for Cameroon.

3) Mother's anemic condition

Maternal anemia is an explanatory factor for pediatric anemia. It is also the third-ranked factor contributing toward an explanation of the overall model. The children of anemic mothers who live in rural areas have a 1.63 times greater risk of being anemic in comparison with the children of non-anemic mothers living in the same areas. The comparable risk is 1.49 in urban areas.

4) Mother's educational level

Educational level is the fourth-ranked explanatory factor for pediatric anemia in urban areas and the sixth-ranked explanatory factor in rural areas. Children in rural areas whose mothers have a secondary level or higher education have a 22% lower risk of developing anemia than do the children of less educated mothers.

5) Delayed growth

Delayed growth is ranked as the fifth leading factor in rural areas and the seventh leading factor in urban areas. Children with this type of malnutrition in rural areas have a 1.41 times greater risk of anemia than their counterparts. For the same group of individuals in urban areas, this risk is 1.34.

6) Illnesses associated with pediatric anemia

Although the illnesses experienced by the children during the two-week period preceding the survey are not an explanatory factor for anemia in urban areas, they do nevertheless rank fourth among the factors for the rural areas. These illnesses consist of diarrhea, cough, and fever. Consequently, those chil-

dren who did not experience these illnesses during the period in question have a 30% lower risk of being anemic in comparison with the children who were ill.

.....

“In Cameroon, anemia is an indicator of the deterioration in the state of health of the population at large”

.....

Conclusion

As in most Sub-Saharan African countries, in Cameroon anemia is an indicator of the deterioration of both the nutritional status and the state of health of the population at large, and particularly of children under 5 years of age. It is a major public health problem. It can be characterized as a “silent burden,” because it affects the growth and development of individuals as well as socioeconomic, familial, community, and national development, even though it is not as heavily publicized.

Accordingly, it is important to implement an anemia monitoring system in Cameroon, because such a system would not only help provide information about the evolution of the situation in the country and about the corresponding determining factors, but also serve as a resource for evaluating the intervention programs that have been implemented.

.....

Correspondence: Jonas Tchassem Pinlap,
Demographer, Institut de Formation et de Recherche
Démographique (IFORD), 1556 Yaoundé, Cameroon
E-mail: tjonas85@yahoo.fr

.....

References

01. MICS: Multiple Indicators Cluster Survey.
02. Centers for Disease Control and Prevention (CDC). The adjustment ranges from 0 g/L at an elevation of 1,000 meters to 45 g/L at or above an elevation of 4,500 meters.

My Time as an Intern at *Sight and Life*

Max Voegtli

Glocoms, Phaidon International, London, UK



Max Voegtli, *Sight and Life* intern.

I joined *Sight and Life* in August 2014, straight after graduating from York University, UK, with a BA in Politics with International Relations. Like many young students of politics, I had spent many hours studying, learning, and debating the challenges of the world we were entering. We were invigorated by these new ideas and by the way in which different strands of theory proposed markedly different solutions to similar problems. We took in tried and tested ideas and merged them with new ones that were coming to the fore as the world around us changed.

After three years of experimenting with ideas in this way, it was finally time to test our thinking in a real-world situation. This is where *Sight and Life* as an organization caught my attention.

As many of you will know, *Sight and Life* is a humanitarian nutrition think tank that works toward a world free of malnutrition and is focused on three main fields of action: advancing research, sharing best practice, and mobilizing support. To me, this was an

organization that wasn't merely focused on understanding the problems around us, but actually dedicated to finding solutions to these problems and ensuring that those solutions are acted upon and that they are also sustainable.

This is what attracted me to *Sight and Life*.

The transition from MDGs to SDGs

At *Sight and Life*, I was to put into practice the many ideas I had explored during my time at university, when it became clear to me that we needed new ideas for a changing world. This was also the time of the transition from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs).

The MDGs were developed and implemented at a time when the world was on the up. The Cold War had ended peacefully, many nations had achieved the independence they had long craved, and there was success in many fields, such as combating disease and improving technology. The MDGs were formulated at a time of optimism, to move the world – especially the developing world – forward. However, new problems emerged, and world society evolved in a manner that prevented the MDGs from fully ushering in the promised dreams.

“The MDGs were written to move the world forward”

The MDGs have expired now, with some having been met and a long battle still ongoing to achieve others. Progress toward achieving the MDGs was uneven. Many praised the MDGs for making states accountable and giving them specific goals to strive for. Others criticized them, saying that the MDGs “failed to consider the root causes of poverty and overlooked gender inequality as well as the holistic nature of development.”¹ This is where the SDGs follow. Instead of eight goals, the number has now been expanded to 17 to cover some of the issues that needed specific attention, for example violence against women. The SDGs are also global goals now, with relevance to developed as well as developing countries.

Being able to study this transformation and the debate around it at university was exciting in itself, but *Sight and Life*

allowed me to look even deeper into root causes and what we could do to tackle a wide range of societal issues. While working with the team, I was very aware of how “fresh” I was to this world, with the experience of many, including Eva Monterrosa, Anne-Catherine Frey, Svenia Sayer-Ruehmann and of course Klaus Kraemer, guiding me.

Working as part of *Sight and Life* forced me to sit up and look at the situation in a real-world context. Things were no longer possible simply because they made sense on paper. Hidden and unplanned-for issues arise when development plans are enacted, issues that have to be dealt with if one is to move forward and be successful. It was during my internship that I learned how to try to predict issues and deal with them as they arose, attempting to find an appropriate response as I went along.

The SDGs give us a broader understanding of what is required to move forward. While the MDGs were mostly focused on poorer countries that were finding their feet after decades of civil war, disease and famine, the SDGs are a truly global effort, with all states being held accountable, no matter how large or rich they may be. A key requirement for improving the chances of success for the SDGs is that everyone should work together in true partnership.

.....

“Every organization has its part to play in finding the best solutions”

.....

Finding the best solutions

Every organization has its part to play in finding the best solutions and disseminating these to the organizations that can best implement them and scale them up. This is one of the key things I learnt during my time at *Sight and Life*. Here, a relatively small think tank, with only six permanent members of staff, is able to have a disproportionate influence on the direction of discourse. *Sight and Life* has played a crucial role in many projects, touching lives for the better all over the world. *Sight and Life* is also able to link larger elements of society (such as business) with established NGOs to create a more effective joint effort. Each side brings its own specific expertise, providing a more effective total solution – and that is vital.

The importance of sharing ideas means that more people and groups need to get involved in solving complex challenges. As human beings, we are all different, having grown up in different cultures and with different attitudes – attitudes that shape how we think as we become adults. By harnessing the various perspectives of different people from all around the world, we are able to combine these experiences to create effective solutions that will make the world a better place.

I experienced this myself when *Sight and Life* gave me and a colleague financial assistance to allow us to attend a conference on Sustainability in Copenhagen, where we presented our ideas on maize and rice fortification in South America. Not only was this an incredible opportunity for me: it also allowed me to interact with many amazing people who, through their various experiences, brought a very different way of thinking to bear on my own ideas and thought processes. I met young idealists like myself, older practitioners with a wealth of experience, and up-and-coming scientists who were starting to make a name for themselves. All these individuals challenged my ideas, just as I did theirs, and from that we were able to bring forth new concepts and thus continue the debate in our own areas of specialism.

Bridging different worlds

In my view, *Sight and Life* plays a crucial role as a bridge between all these different worlds – a bridge between multi-national companies and leading NGOs, both with large budgets, lots of experience, and their own roles to play. *Sight and Life* gives them the platform to jointly discover and implement the best solutions.

Sight and Life has taught me many things – how to spot and factor in hidden issues, for instance; how to link the worlds of different players to bring about a more united effort; and also how to challenge existing ideas so as to improve them or even replace them entirely. I was able to draw on the team’s years of experience while also being free to contribute my own ideas. *Sight and Life* gave me my own platform to look at issues I care about, and for that I am extremely grateful.

Now it is time for me – and for and the many others whom *Sight and Life* has hosted as interns – to take these lessons and propagate them as we go forward with our careers.

.....

Correspondence: Max Voegtli,

Glocomms, Phaidon International, London, UK.

E-Mail: Max.voegtli@gmail.com

.....

References

01. “Sustainable development goals: all you need to know,” last modified January 19, 2015, www.theguardian.com/global-development/2015/jan/19/sustainable-development-goals-united-nations.

Implementation of Multiple Irish Aid-Funded Orange Flesh Sweet Potato Projects

Nicolai Petry, James P Wirth

GroundWork, Crans-près-Céligny, Switzerland

Ben Siddle, Mags Gaynor

Irish Aid, Department of Foreign Affairs and Trade, Limerick, Ireland

Biofortification of sweet potatoes is a promising and sustainable agricultural approach to reduce vitamin A deficiency (VAD), particularly in remote areas where individuals have limited access to commercial markets and mainly rely on household-produced crops.^{3,4} Due to its large genetic variability, its favorable growing characteristics, and the high consumption in remote areas, the orange flesh sweet potato (OFSP) is one of the major targeted crops of biofortification initiatives. OFSP have high concentrations of provitamin A and are the most advanced biofortified crop in terms of research studies demonstrating bioavailability, efficacy, and effectiveness.⁵⁻⁷

OFSP are now being introduced in many parts of Africa and South America, and the Sweet Potato for Profit Health Initiative, launched by the International Potato Institute in 2009, seeks to reach 10 million households by 2020. Since 2009, eight Sub-Saharan countries have released 31 OFSP varieties. As part of its broader support of biofortification and the Consultative Group on International Agricultural Research, Irish Aid has provided funding to five projects in Sub-Saharan Africa promoting and disseminating OFSP (Table 1). This report was undertaken to better understand the common accomplishments and challenges of these five projects in order to identify common factors for success.

“OFSP are the most advanced bio-fortified crop in terms of bio-availability, efficacy, and effectiveness”

Results

The five projects aimed to improve nutrition and health in populations vulnerable to VAD by stimulating the production and consumption of OFSP and other micronutrient-rich foods. All projects used an integrated approach whereby production of OFSP was accompanied by behavior change communication (BCC) activities to increase uptake by farmers and to sensitize consumers to a new product.

Biofortification: A key nutrition strategy

Over the past 15 years, biofortification has been a strategy to address multiple Millennium Development Goals (MDGs), such as eradicating extreme hunger and poverty, improving maternal health, and ensuring environmental sustainability.¹ With the MDGs being replaced by the Sustainable Development Goals (SDGs), biofortification will be a continuing strategy to reduce micronutrient deficiencies, and will be a key nutrition strategy of the new goals to improve nutrition through sustainable agriculture.²



Child holding orange flesh sweet potato, Kazizi village, Sanga district, Niassa Province, Mozambique, 2013.

TABLE 1: Overview of Ireland-funded OFSP projects.

Country location and project name	Project period	Geography and planned coverage
Ethiopia – Tigray “Alleviation of Food Insecurity and Malnutrition in Tigray, Ethiopia, through Promotion of Potato and Sweet Potato”	March 2011–April 2013	Implemented in 5 <i>woredas</i> (districts) in Tigray region ➤ Estimated coverage = increase coverage from 3,000 to 8,000 households
Ethiopia – SNNPR “Alleviation of Food Insecurity and Malnutrition in SNNPR, Ethiopia, through Promotion of Potato and Sweet Potato”	November 2012–October 2014	Implemented in 5 <i>woredas</i> in SNNPR ➤ Estimated coverage = 1,500 households
Malawi “Rooting out Hunger in Malawi with Nutritious Orange-Fleshed Sweet Potato”	October 2009–April 2014	Implemented in 15 districts ➤ Estimated coverage = 70,000 rural households
Mozambique – Niassa province “Nutritious OFSP for Niassa: Combating Food Insecurity & Vitamin A Deficiency through Effective Delivery of a Biofortified Crop”	2012–2015	Implemented in six districts in Niassa province ➤ Estimated coverage = 20,000 households
Mozambique – Tete province “Enhancing Agriculture for Better Nutrition Outcomes for Children in Mozambique”	December 2011–December 2014	Implemented in one district in Tete province ➤ Estimated coverage = 3000–5000 households

Project timeframe represents contract duration between Ireland funding (either Hunger Unit or national embassy) and grantee. Only the Mozambique-Niassa project received funding prior to the program.

Vine supply and extension systems

An extensive and robust vine supply and extension system is crucial for the sustainable introduction of OFSP. Timely availability of high-quality planting material and conservation of vines for the next season must be guaranteed in order to meet the growing demand from farmers. Although sweet potatoes are less affected by soil and weather conditions than other staple crops, droughts and floods can nonetheless affect harvests. To assure constant vine supply, vine multipliers should have access to water and irrigation equipment so as to maintain supplies of vines during the dry periods. Training workshops on agricultural techniques and post-harvest technologies can help to improve the vine supply and extension systems.

The review of the projects revealed that the three following components of decentralized vine multiplication systems were indispensable for the successful OFSP projects: **1)** growing large quantities of OFSP vines for dissemination by trained decentralized vine multipliers; **2)** distributing vines to project farmers; and **3)** teaching project farmers in OFSP growing techniques (Malawi, Mozambique-Tete and Mozambique Niassa). Notably, all projects reviewed distributed OFSP vines for free using voucher systems in order to facilitate adoption of a new crop and to initially boost the production of OFSP.

Demand creation and promotion

BCC activities are important to raise awareness about essential nutrition actions, agronomic practices, and OFSP’s role in VAD reduction. All of the projects used BCC activities to promote the production and consumption of OFSP, but depending on the situation in country, the strategic alignments of BCC activities differed. The focus of the Ethiopia-Tigray project, for example, was on the promotion of OFSP, since sweet potatoes were not historically consumed there, which is different to the project in Malawi, where less emphasis was on BCC activities, since sweet potatoes are a major staple food. The lead mother/care group model has been used in numerous projects in Mozambique as a way of spreading health/nutrition messages at the household and community level in a culturally appropriate manner and at low cost. BCC messages related to positive health behaviors and child care and feeding practices were included in the Ethiopia-Tigray and Mozambique-Tete projects.

Sustainability and considerations for future OFSP projects

The sustainability of the investigated projects was influenced most by the vine supply and extension system, the demand for OFSP and OFSP products, and familiarity and prior consump-

tion of sweet potatoes. Decentralized vine multiplication systems were found to be the most successful as they facilitated the production and dissemination of large quantities of OFSP vines. Moreover, decentralized systems supported by agricultural extension enabled farmers to learn OFSP growing techniques, conserve vines for the next season, and keep pace with the demand for OFSP vines.

“Projects created clear incentives for diffusion and adoption”

By facilitating contract production for local markets, women’s organizations, and the production of value-added products (e.g. OFSP flour), projects created clear incentives for diffusion and adoption. While home consumption is often encouraged as part of BCC communications, a balance of home consumption and sales may provide a more sustainable approach for households by serving as both a food supply and an income source. Extensive nutritional education should also be provided to beneficiaries so that they know about the nutritional benefits of consuming OFSP. The development of markets for OFSP should take place shortly after project initiation and is essential to reach non-farming or rural households that are net buyers of food. This

strategy stimulates households to produce surplus production and at the same time assure sufficient home consumption.

Frequent consumption is one of the main criteria for a successful introduction of a biofortified crop. Biofortified crops must be consumed on a routine basis (i.e., daily or at least multiple times a week) in order to have a significant nutritional impact. Biofortified crops that are similar to staples already consumed are more likely to be accepted by the consumers, facilitating program implementation and nutritional impact.⁸

“Biofortified crops must be consumed on a routine basis to have a significant nutritional impact”

Future research required

The nutritional impact of OFSP has only been observed in Mozambique. None of the projects provide information about the direct impact of OFSP consumption on the reduction of vitamin A deficiency. Program data, such as adoption rate, percentage of households growing OFSP, and home consumption, are only indirect measures which provide at best an approximation of OFSP impact. While not all implementing agencies will have the technical ability or resources to conduct impact surveys where



Vine vegetation 7 weeks after transplantation; Lussanhando village, Lichinga district, Niassa, Mozambique, 2014.



Children with newly harvested orange-flesh sweet potatoes, Lussanhando village, Lichinga district, Niassa, Mozambique, 2015.

vitamin A intake and status are measured, there is a need for additional evidence of the biological effectiveness of OFSP from other countries and agro-ecologic environments. Examining the nutrition impact on selected future projects is important to both improve the evidence base of OFSP (and of biofortification in general) and evaluate if the program is having the intended impact.

Correspondence: *Nicolai Petry,*

GroundWork, 40b Les Landes, Crans-près-Céligny, Switzerland

Email: *nico@groundworkhealth.org*

References

01. HarvestPlus. MDG – The Millenium Development Goals. 2015 [cited 2015 August 2015]; Available from: www.harvestplus.org/content/mdgs
02. SDSN. Indicators and a monitoring framework for Sustainable Development Goals; 2014.
03. Nestel P, Bouis HE, Meenakshi JV et al. Biofortification of staple food crops. *J Nutr* 2006;136:1064–7.
04. Mayer JE, Pfeiffer WH, Beyer P. Biofortified crops to alleviate micronutrient malnutrition. *Curr Opin Plant Biol* 2008;11(2):166–70.
05. Ruel MT, Alderman H, Grp MCNS. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 2013;382:536–51.
06. Hotz C, Loechl C, Lubowa A et al. Introduction of beta-Carotene-Rich Orange Sweet Potato in Rural Uganda Resulted in Increased Vitamin A Intakes among Children and Women and Improved Vitamin A Status among Children. *J Nutr* 2012;142:1871–80.
07. Low JW, Arimond M, Osman N et al. Food-based approach introducing orange-fleshed sweet potatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. *J Nutr* 2007;137:1320–7.
08. Gilligan DO. Biofortification, Agricultural Technology Adoption, and Nutrition Policy: Some Lessons and Emerging Challenges. *Cesifo Economic Studies* 2012;58:405–21.

United Nations 53rd Graduate Study Program

Geneva, Switzerland

Adedotun J Owolabi

Department of Human Nutrition, University of Ibadan,
Ibadan, Nigeria

Every year, as part of the educational outreach programs undertaken by the United Nations, the Information Service at Geneva organizes a Graduate Study Program. This program provides an opportunity for outstanding young postgraduate students from all over the world to deepen their understanding of the principles, purposes and activities of the United Nations and its related agencies via first-hand observation and study at the offices of the United Nations in Geneva.

This year's program, which lasted two weeks, attracted 75 graduate students representing 37 countries of the world. The young academics gathered in Geneva to deliberate on the theme: "From Millennium to Sustainable: Crafting new development goals for the future we want."

Fresh thinking in the face of growing challenges

The eight Millennium Development Goals (MDGs) – which range from halving extreme poverty rates through halting the spread of HIV/AIDS to providing universal primary education – will be concluded this year. They will be replaced by the Sustainable Development Goals (SDGs), which will run for the next 15 years.

Sessions of the Graduate Study Program were delivered by staff of various different United Nations Organizations, such as the World Health Organization (WHO), the United Nations Development Programme (UNDP), the United Nations Children's Education Fund (UNICEF), the World Meteorological Organization (WMO), and the International Telecommunication Union (ITU), among others.

Study program participants formed working groups and, under the guidance of United Nations experts, developed new ideas for tackling challenges related to climate change, poverty reduction, and trade & development. The prime objective of these working groups was to engage participants in creative thinking processes aimed at producing innovative ideas that could add real value to ongoing endeavors.

“Development cannot be sustainable if it does not address the challenge of climate change”

Ban Ki-moon, UN Secretary-General

Overview of the activities of the Working Groups

World Meteorological Organization

Climate Change and Youth: We are the last generation that has a choice

Led by Clare Nullis, the 53rd Graduate Study Program WMO Working Group was challenged to think about how to engage with other young people so as to tackle the challenges posed by climate change.

An indicator for the urgent need for action in this matter was the inspiring result of the global “My World” survey,¹ which shows the consistently low significance attributed to “Actions taken on climate change” in the overall list of priorities. Based on this analysis, this Working Group focused on the possibility of bridging the gap between the perception and the reality of the effects of climate change among young people. Particular focus was on ways of convincing young people to take action on climate change by building on the strengths of a widely established social media tool – a Facebook page called “Actions We Take”,² in reference to the “My World” survey and the “The World We Want” website report.³

United Nations Development Programme

World Alliance of Cities against Poverty (WACAP)

Under the guidance of Adam Rogers, the UNDP Working Group, to which I was assigned, worked on the action plan and final proposal for a project called WACAP – the World Alliance of Cities against Poverty. WACAP is a global network of municipal governments established by the United Nations Development Programme (UNDP) to mobilize information and resources with the aim of combating poverty. This project is a response to the following situation.



Friends United in Geneva: Priyamka Manohar, Luiz Carlos, Adedotun Owolabi and Lionel Clesly Voss (left to right).

Some 3.9 billion people – more than half of humanity – now live in urban areas. In 2014, the world's urban population accounted for 54% of the total global population (up from 34% in 1960). It is expected to grow to two-thirds of the earth's population by the year 2050. In terms of absolute numbers, this expansion is concentrated in the less developed regions of the world, where the urban population is expected to grow at a rate of approximately 1.84% a year between 2015 and 2020, 1.63% a year between 2020 and 2025, and 1.44% a year between 2025 and 2030. This dramatic demographic shift will pose significant challenges to municipalities which are already struggling to provide adequate housing, transportation, employment, energy and social services for their inhabitants.⁴

Creating inclusive urban environments that embrace sound, sustainable principles for this growth and providing for their inhabitants is an important goal of the post-2015 development agenda, and will go a long way to determining whether cities succeed or fail in creating livable habitats that can meet the basic needs of their populations.

The UNDP Working Group developed a model that will sustain the organization and will contribute to the overall objective of WACAP, which is to create a new generation of cities in which people are provided with the resources and opportunities that will enable them to achieve a high quality of life. This input will be used at the next WACAP Executive Steering Committee Meeting, which will take place in Macau, China.

United Nations Conference on Trade and Development (UNCTAD)

Using Trade and Investment for Sustainable Development, Surpassing the Past, Fulfilling the Future: Youth as the driving force

The UNCTAD Working Group, which was under the leadership of Ms Miho Shirotori and Mr Galloway, worked on a project explor-

ing trade & investment as a pivotal tool in achieving the Sustainable Development Goals, with young people as the driving force behind the endeavor.

As readers may be aware, the UN Sustainable Development Agenda is an all-encompassing strategy aimed at fostering a global social, economic and environmental architecture that is equitable, inclusive and sustainable for the existing population, as well as for generations to come. The UNCTAD working group project elaborated mechanisms for different stakeholders within the private sector, the public sector, and civil society to leverage trade and investment which can benefit tomorrow's leaders and agents, with a focus on youth engagement. The goal of this project is to improve the global architecture of trade and investment for all countries, with a special focus on developing countries, so as to achieve economic prosperity while incorporating the new global goals for sustainable development.

To reduce poverty and end inequality requires inclusive growth that allows everyone to contribute; and trade and investment are major catalysts that can ameliorate these struggles.

Conclusion

Ensuring that leaders take ambitious decisions to reduce poverty and inequality and protect our planet is everyone's responsibility. Only then can implementation of the Sustainable Development Goals help lift everybody into a better future.

Acknowledgement

The author gratefully acknowledges the generous financial support of *Sight and Life*, which made it possible to participate in this study program.

Correspondence: Adedotun J Owolabi,

Department of Human Nutrition, University of Ibadan, Ibadan, Oyo state, Nigeria. Email: adedotunowolabi@gmail.com

References

01. www.myworld2015.org/index.html, accessed July 2015.
02. www.facebook.com/actionswetake/?fref=ts. Accessed July, 2015
03. www.worldwewant2015.org. Accessed July, 2015
04. Rogers A. Global Strategy (Draft) – A report to the United Nations Development Programme on the state of the WACAP network, with recommendations for restructuring. June 8, 2014, pages 2–3.

14 LIFE BELOW WATER

.....
Healthy dietary choices can be good
for the planet
.....



Financing for Development: Mobilizing leadership and investment in nutrition

Chris Dendys

Micronutrient Initiative, Ottawa, Ontario, Canada

The Third International Financing for Development (FfD) conference, held in Addis Ababa, Ethiopia, in July 2015, marked a major moment for the global development community. The conference gathered high-level political representatives, including Heads of State and Government, and Ministers of Finance, Foreign Affairs and Development Cooperation, as well as other relevant stakeholders, including 600 civil society networks and more than 400 business representatives.

**“A basis both for
financing sustainable development
and for developing
sustainable finance”**

The Addis conference was the first of three global moments in 2015 aligned in support of a new, post-MDG, sustainable development agenda. The other landmark moments included the adoption of the 17 Global Goals at the UN General Assembly (NY, September 2015) and the UN Climate Change Conference to establish a global agreement on climate change (Paris, December 2015). FfD was significant in its practical objective, which was to identify concrete pathways to make good on the ambitious goals to come. The conference resulted in a new global framework for financing sustainable development and a package of over 100 concrete measures drawing on all sources of finance, technology, trade and data that will ultimately support the implementation of the SDGs. In describing the framework agree-

ment, the conference’s Secretary General, Wu Hongbo, put it this way: “This framework is a basis both for financing sustainable development and for developing sustainable finance.”

A critical opportunity

Nutrition advocates saw the conference as a critical opportunity to keep nutrition high on the global agenda and bring the nutrition story to a broad set of decision-makers and global change agents. The Micronutrient Initiative (MI) was pleased to co-host an official side event at the conference, alongside partners including the Government of Ethiopia, the Bill & Melinda Gates Foundation (BMGF), the Children’s Investment Fund Foundation (CIFF), UNICEF, the World Bank (WB), Results for Development (R4D), and 1,000 Days.

The high-level briefing and panel discussion, Financing Growth: Mobilizing Leadership and Investment in Nutrition, had two key objectives:

- > Highlight the importance of prioritizing nutrition financing within the SDG agenda; make the economic case for investing in nutrition; and highlight financing options (traditional, domestic, innovative, etc.); and
- > Serve as a launching pad for the first global costing of the World Health Assembly (WHA) target to reduce stunting by 40%, as well as provide financing scenarios to address the global resource gap. This was the first in a series of expected costings associated with the six WHA nutrition targets.

The imperative for countries to take action to scale up nutrition

Moderated by MI President Joel Spicer, the event opened with an inspired address by Ethiopia’s First Lady, Her Excellency Mrs Roman Tesfaye. As a SUN country, and because of Ethiopia’s



Her Excellency Mrs Roman Tesfaye, First Lady of Ethiopia, addresses the audience at the Financing Growth: Mobilizing Leadership and Investment in Nutrition event.



Meera Shekar, Global Lead, Nutrition, at the World Bank, presents the first in a series of costing and financing scenarios to reach the WHA global nutrition targets at the Financing Growth: Mobilizing Leadership and Investment in Nutrition event.

own deep and historic connection with famine, nutrition has become a priority focus for the government of Ethiopia (see box on Seqota Declaration), and the First Lady provided a welcome perspective on the imperative for countries to take action to scale up nutrition.

The side event then provided a platform for the release of important new costing analysis and financing scenarios linked to the WHA stunting target, to reduce stunting by 40% by 2025. The WB, R4D and 1,000 Days, in partnership with the BMGF and CIFF, estimated the cost of scaling up the seven interventions that have the highest impact on stunting reduction.

“By 2025, 74 million children could escape the scourge of stunting”

Their findings showed that expanding coverage of this set of critical interventions would cost approximately US\$8.50 per child per year. If sustained over 10 years, this relatively modest investment, together with improvements in the underlying determinants of malnutrition (improvements in GDP growth, food availability and diversity, women’s health, education, and empowerment), would allow the international community to succeed in meeting the WHA stunting target. More importantly, by 2025, approximately 74 million children would escape the scourge of stunting, and be better able to contribute to the growth of national economies. The impact would be far-reach-

ing as the return on investment for reducing stunting is one of the best investments in health and development: an average US\$18 for every US\$1 invested.

Defining a pathway to make critical investments achievable

Per child estimates are critical to driving home the affordability and imperative of investment. When rolled up, according to the WB and R4D analysis, strategic scale-up of evidence-based stunting interventions in the 37 high-burden countries (85% of stunting) will require US\$42 billion over the coming decade. Extrapolating to the rest of the world, a total of US\$49.6 billion more will be needed to combat stunting over 10 years. Given this costing, it is equally critical to define a pathway, or present scenarios, that make this price tag achievable. As a corollary to the costing presented by Meera Shekar, Nutrition Lead for the World Bank, there was a presentation on financing scenarios presented by Rob Hecht, Managing Director of Financing for Development. The underlying message was that while we need donors to sustain and grow their commitments and to leverage their convening power and influence, we also need others to bring resources and solutions to the table as well:

- > We need a “global solidarity” approach that sees an expanded accountability for financing nutrition.
- > Governments must prioritize nutrition, and provide adequate funding for nutrition programs. At least 30 SUN countries have come forward and made their budget allocations to nutrition known. It is time for the rest of the world to follow their example.



Dr Robert Hecht, Managing Director, Results for Development, talks about the cost of reducing stunting by 40% at the Financing Growth: Mobilizing Leadership and Investment in Nutrition event.



From left to right:

Dr Caroline Anstey, Global Head, UBS; the Hon. Christian Paradis, former Canadian Minister for International Development and Minister for La Francophonie; Joel Spicer, President and CEO, the Micronutrient Initiative; José Andrés Botrán Briz, President, Compañía Agrícola Industrial Santa Ana; and Dana J Hyde, CEO, Millennium Challenge Corporation.

- > We need new and innovative financing solutions to help address funding gaps, and spark innovation and creative solutions.
- > We need implementing agencies to identify missed opportunities for impact, and to work together to take advantage of existing investments in platforms reaching our target populations, to enhance their nutrition.

To underscore the theme of new financing, new approaches and new partnerships, the side event concluded with an arm-chair discussion moderated by MI President Joel Spicer.

“We need a ‘global solidarity’ approach”

The bottom line?

The message that came out of the side event at FfD was clear: business as usual is not the solution. Meeting global targets to address malnutrition will require new financing solutions, new leadership, new partnerships, increased accountability and political will. It will require a concerted effort by all partners to move out of low gear, and commit to accelerated progress.

Correspondence: Chris Dendys,

Director External Relations, Micronutrient Initiative,
180 Elgin Street, Suite 1000, Ottawa, Ontario, Canada, K2P 2K3
Email: cdendys@micronutrient.org

The Seqota Declaration

Ethiopia’s pledge to end malnutrition in a generation

The famine in Ethiopia in the 1980s was a catastrophic disaster. By 1983, approximately 7.8 million Ethiopians were struggling for survival, and an estimated 700,000 had perished. Hundreds of thousands of people were starving by the time images of emaciated children reached TV screens around the world and prompted international reaction.

A highlight of the Financing for Development Conference was the launch of the Seqota Declaration – an ambitious pledge by the Ethiopian government to end childhood malnutrition in Ethiopia within a generation.

The Seqota Declaration lays out a plan to stop the cycle of undernutrition by bringing together all areas of government. The Seqota Declaration and the government of Ethiopia are betting that we can win the fight against malnutrition if we apply the right tools, adequate resources, and political will.

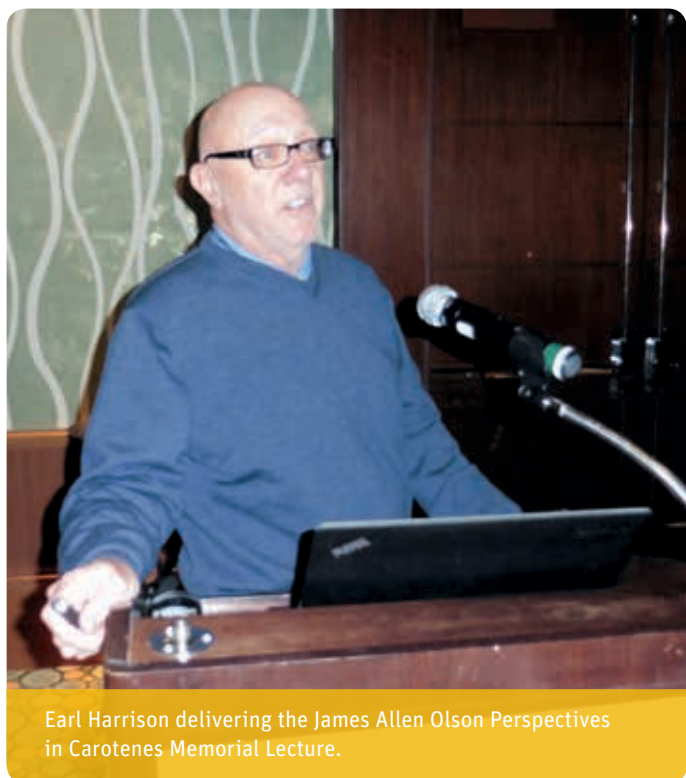


A WFP field worker conducts a survey of WFP beneficiary households at Mirjagong Union, Bangladesh.

Carotenoids Research Interaction Group (CARIG) 2015 Conference

Noel W Solomons

CESSIAM, Guatemala City, Guatemala



Earl Harrison delivering the James Allen Olson Perspectives in Carotenes Memorial Lecture.

The 2015 CARIG Conference was held in Boston on the eve of the Experimental Biology meeting. Sherry Tanumihardjo was the moderator, and the annual James Allen Olson Perspectives in Carotenes Memorial Lecture – presented elsewhere in this issue – was delivered by Earl Harrison of Ohio State University. It was titled “Conversion of Dietary Carotenoids and Vitamin A into Bioactive Retinoids: Exploring Trails Blazed by Jim Olson.”

The unifying theme of the conference was Carotenoids, Retinoids and Cancer. Four complementary presentations provided a comprehensive and congruent focus on the role of carotenoids and their derivative metabolites in the processes of protection from, induction of, and progression of, malignancy.

Retinoic acid biosynthesis defects in cancer

In the first presentation of the series, Maureen Kane (Baltimore School of Pharmacy at the University of Maryland, USA) spoke on the topic of “Retinoic Acid Biosynthesis Defects in Cancer.” The protagonist of the presentation was cellular retinol-binding protein 1 (CRBP-1), a critical element of the retinoid regulatory pathway. Kane covered aspects of the changes in CRBP-1 phenotypes and the associated retinoid metabolites and their roles in cellular hyperplasia and cancer. Her findings were based on a unique analytical capacity for quantifying retinoid species that exists in her laboratory in Baltimore: this uses fast liquid chromatography-tandem mass spectrometry with backflush technology. Kane’s pivotal observation was about levels of retinoic acid (RA), the retinoid metabolite that acts in the complex system of regulation of transcription in the nucleus for protein synthesis. Evidence suggests that the underlying substrate for RA in the cellular retinyl-esters pool is not limited in cells in either normal or hyperplastic conditions. The research group then reasoned that a downstream action – such as chaperoning that retinoid into the metabolic conversion – would be the regulatory step. CRBP-1 comprises that chaperone.

Kane detailed evidence for reduced RA biosynthesis in cancer, and explained how demonstrations with genetic manipulation (knock-out mice) and external stressors (hypoxia), among other factors, indicate that the CRBP-1 process of chaperoning of retinoids within the cell is likely the sensitive step in this mechanism. As a final speculation, Kane linked these findings with the conjecture that measures to restore CRBP-1 with the object of increasing RA availability in proliferative or malignant disorders (such as by epigenetic reprogramming or pharmacological induction) might offer therapeutic promise.

The antioxidant conundrum

Next in the series was the presentation by Harold Seifried (National Cancer Institute of the NIH in Bethesda, Maryland, USA) entitled “The Antioxidant Conundrum: Just Do It???” Seifried began by relating an old theory of tumor biology, which proposes that if cancer therapy generates excessive levels of oxidative



Harold Seifried, National Cancer Institute of the NIH in Bethesda, Maryland, USA.

free radicals, then oxidants will be protective against neoplasia. To set the stage for the “conundrum,” Seifried then cited the classic paper by Gladys Block and colleagues.¹ The authors of that paper comment: “A statistically significant protective effect of fruit and vegetable consumption was found in 128 of 156 dietary studies in which results were expressed in terms of relative risk.” This constitutes 85% of the evidence extant two decades ago.

“Measures to restore CRBP-1 might offer therapeutic promise”

The question to resolve, then, was whether dietary antioxidants were promoting of, or rather protective against, the occurrence of cancer.

The best-known β -carotene (BC) intervention trials in smokers – in which average daily doses ranged from 20 to 30 mg, and in which the prevention of lung cancer was the objective – were illustrative. In the Alpha-Tocopherol, Beta-Carotene Cancer Prevention (ATBC) study in Finnish smokers and the Beta-Carotene and Retinol Efficacy Trial (CARET) in North American smokers and men exposed to asbestos, the paradoxical finding was that of increased mortality from lung malignancies in the treatment arms. Seifried speculated that tobacco metabolites may interact to make BC into a pro-oxidant. The long-term follow-up of the ATBC study has found substantial reduction of colon cancer (-22%), prostate cancer (-32%) and chronic mor-

tality (-25%). Similarly, in a sub-study from CARET among men who gave up smoking, various protective effects have been found in the follow-up monitoring.

In France, the SU.VI.MAX trial (abbreviated from its French title of *Supplémentation en Vitamines et Minéraux Antioxydants*) was a double-blind, randomized, placebo-controlled trial testing, for 7.5 years, the effect of a combination of antioxidant vitamins and minerals (120 mg vitamin C, 30 mg vitamin E, 6 mg β -carotene, 100 μ g selenium and 20 mg zinc) at doses considered to be nutritional. Follow-up of SU.VI.MAX participants has identified a 58% reduction in prostate cancer, and a 31% decline for all cancers.

The high doses of BC in the trials, associated with high serum levels in the subjects, do not reflect physiological exposures. Nonetheless, reflecting on the data, BC may have been safe – and often protective – in the non-smokers within the trials. Combined with the early epidemiologic findings, antioxidants in the homeostatic range seem to exert a protective role, and high doses turn pro-oxidant.

“Antioxidants in the homeostatic range seem to exert a protective role, and high doses turn pro-oxidant”

Tomato carotenoids and fatty liver disease and liver cancer

Next, Xiang-Dong Wang of the Human Nutrition Research Center on Aging in Boston, MA, USA spoke on “Tomato Carotenoids and Fatty Liver Disease.” A number of nutritional factors have been implicated in liver cancer. Overweight and consumption of alcoholic beverages are causative factors for liver cancers, whereas coffee-drinking decreases liver cancer in both sexes. In animal models, the dietary combination of alcohol and high-fat diet induces fatty liver. This can progress in both humans and animals through a sequence that leads from simple steatosis through fibrosis to cirrhosis, and finally to hepatocellular carcinoma.

Wang related this background to the topic of interest with a focus on lycopene and tomato extract treatments. In rats on a high-fat diet, supplementation with both treatments abolishes the carcinogenic effect. Tomato extract reduces peroxidation and reduces alcohol-induced hepatic inflammation. Lycopene induces an anti-inflammatory mechanism. The lycopene attenuation depends on the carotenoid cleavage enzyme. A metabolite derivative of lycopene via the eccentric oxidative cleavage, α -10'-lycopenoic acid (ALA), decreases fat accumulation in the Ob/Ob (obese) mouse model.

Finally, on the mechanistic side, a deacetylase enzyme known as Sirtuin 1 may be instrumental in the hepatic cancer context. Sirtuin 1 is a mediator, via the transcription factor NF κ B, of reduced inflammation. It is induced by several well-known factors such as nicotinamide adenine dinucleotide (NAD), resveratrol, and caloric restriction. A final established Sirtuin 1 inducer is the carotenoid family, and this represents a feasible linkage of lycopene to a suppression of the pathway to hepatic tumorigenesis.

“Lycopene can be linked to a suppression of the pathway to hepatic tumorigenesis”

Tomato carotenoids and risk of prostate cancer

Concluding the conference was a paper by John W Erdman, Jr (University of Illinois, USA) with the theme of “Tomato Carotenoids and Risk of Prostate Cancer.” Erdman covered five aspects of the topic: Incidence; epidemiology; animal trials; mechanisms; and conclusion. With respect to relative incidence, prostate cancer comprises 28% of malignancies in men, accounting for 9% of cancer deaths. In the Health Professional Health Study in the United States, among other observational studies, consumption of pizza, tomatoes and tomato sauce was inversely related to the total incidence of prostate cancer and deaths from the illness.



John W Erdman, Jr; “Prostate cancer accounts for 9% of all cancer deaths.”

Animal trials have been instrumental regarding the dietary specifics. In one mouse model for prostate cancer, the combination of broccoli and tomatoes reduced the tumor growth more than pure, isolated lycopene. TRAMP is the acronym for an aggressive cancer of the mouse prostate. In dietary studies, soy germ, tomato paste and the combination of the two had significant protective effects in the TRAMP model, with roughly equivalent efficacy. Further animal experimentation reveals insights into the mechanisms. In a knock-out (null) mouse, with absence of the carotene oxidase (BCO2) enzyme for eccentric cleavage, the protective effects of both pure lycopene and tomato against prostate cancer were reduced, suggesting a dependence on cleavage-products. Prostate growth is dependent upon male (androgen) hormones, and protective diets produced inhibition of the enzymes that up-regulate androgens in gene-array studies across the mouse genome. Erdman concluded that lycopene inhibits prostate cancer, most likely through a derivative metabolite originating as a carotenol.

“Lycopene inhibits prostate cancer”

VARIG-CARIG poster competition

In the evening, students and professionals gathered for the VARIG-CARIG Reception.

The prize-winning presentations in the VARIG-CARIG poster competition for graduate and post-doctoral students were as follows:



Xiang-Dong Wang: “A number of nutritional factors have been implicated in liver cancer.”

- > **Emily Mohn**, E Johnson. "Distribution of Lutein Membranes of Rhesus Macaque Brain." Tufts University, Boston, Massachusetts, USA.
- > **Joshua R Smith**, X Gong and LP Rubin. "Selective Carotenoid Growth Inhibition in Breast Cancer: Independence of Hormonal Sensitivity. University of Texas El Paso and Texas Tech Health Sciences Center El Paso, Texas, USA.
- > **Michael R La Frano**, B Gannon, SA Tanumihardjo, JW Newman. "Targeted Metabolomic Profiling of Lipid Mediators and Bile Acids Influenced by Vitamin A Status in a Rodent Model." University of California Davis and University of Wisconsin-Madison, Madison, Wisconsin, USA.

.....

Correspondence: Noel W Solomons,
*Center for Studies of Sensory Impairment,
 Aging and Metabolism, CeSSIAM in Guatemala, P.O. Box 02-5339,
 Section 3163/Guatemala, Miami, FL 33102-5339, USA*
E-mail: cessiam@guate.net.gt

.....

Reference

01. Block G, Patterson B, Subar A. Fruit, vegetables, and cancer prevention: a review of the epidemiological evidence. *Nutr Cancer* 1992;18:1-29.

ADVERT



Nutrition in Africa at the Crossroads

FANUS 2015, Arusha, Tanzania

Adedotun J Owolabi

Department of Human Nutrition, University of Ibadan, Ibadan, Oyo State, Nigeria



Adedotun J Owolabi with his poster presentation at FANUS 2015.

The third Federation of African Nutrition Societies (FANUS) Conference was held in Arusha, Tanzania, from May 25–29, 2015. The conference – which brought together nutritionists, politicians, policy-makers, country representatives from various organizations, government experts, field practitioners and program experts, academics, NGOs, research institutes and other specialists from around the world – analyzed and debated the challenges of improving nutrition in Africa.

I came to FANUS 2015 with great expectations, and these guided the sessions I attended. The conference attracted the presence of nutrition experts from all corners of the globe, such as Andrew M Prentice, Lawrence Haddad, Tola Atinmo, Paul

Amuna, Francis Zotor and Joyce Kinabo (President, FANUS), as well as Nutrition Society executives from other countries in Africa. The scientific program comprised four plenary lectures and 40 parallel symposia. Two hundred and fifty delegates from over 20 countries attended the conference, whose theme was “Nutrition in Africa at the Crossroads.” This broke down into the following seven sub-themes, each of which generated extensive discussion:

- > Nutrition in Africa: Changing patterns and causalities
- > Nutrition as a human right
- > Nutrition governance and accountability: Who is responsible?
- > Breastfeeding and complementary feeding: Why is the obvious so difficult?
- > Maternal nutrition: The neglected factor
- > Obesity and NCDs in Africa: Time to act!
- > Nutrition training and education: Are we providing the right skill-set?

Targeting optimal nutritional status during pregnancy

During the Nestlé-sponsored satellite symposium on Developing a Continuum of Care: The Importance of Nutrition in the First 1,000 Days, Andrew Prentice of the MRC International Nutrition Group gave a lecture entitled “The Importance of Nutrition Throughout the Lifecycle,” which focused on the development of the very early embryo within the first few hours after fusion of the egg and the sperm.

It has been estimated that it requires 47 differentiating cell cycles to make a human being, and that 45 of these occur before the baby emerges from the womb. Each cell division requires an appropriate mix of all the nutritional building blocks and the metabolic cofactors necessary for the smooth running of the anabolic machinery.

Prentice explained how by studying “metastable epialleles” (genomic regions that have highly correlated epigenetic patterns in all tissues) it is possible to study the impact of a mother’s nutritional status right at the time of conception. Using this device, Prentice and his team have been able to show that the season in which a baby is conceived in The Gambia has a profound effect



Adedotun J Owolabi with Eva Monterrosa,
Scientific Manager *Sight and Life*.

on that baby's epigenetic inheritance and that this is mediated by nutrients involved in the machinery required to provide the methyl groups used to modify DNA. The key nutrients are folic acid, vitamins B₂, B₆ and B₁₂, methionine, choline, and betaine.

“Can we translate this basic science into a practicable intervention to benefit mothers and babies worldwide?”

“At first sight this may all seem rather esoteric, but we have evidence that it is likely to be vitally important,” observed Prentice. “Imagine the impact that could be achieved if we could ‘clean up’ most of the errors involved in these processes by ensuring that mothers-to-be had an optimal nutrient status in readiness for pregnancy.” Prentice's last slide asked: “Can we translate this basic science into a practicable intervention to benefit mothers and babies worldwide?” That was a real crossroads for me!

Breastfeeding and complementary feeding

As if that were not enough, there were several breakout sessions on “Breastfeeding and Complementary Feeding: Why is the obvious so difficult?” Idemudia Shulamite Omowunmi from Nigeria assessed workplace support for breastfeeding in southwestern Nigeria. Her view was that there is little or no support

for exclusive breastfeeding in Nigeria as most workplaces in that country do not have crèches where mothers can breastfeed their babies. She argued that places of work should have crèches as a matter of policy. Moreover, breastfeeding mothers receive only three months' maternity leave in Nigeria. Idemudia Shulamite Omowunmi called for this period to be extended, so as to encourage exclusive breastfeeding in the first six months of life. That was another crossroads!

Root crops in Africa: An underutilized resource

I was delighted to give a poster presentation entitled: “Low Investment in Production and Utilization of Root Crops: The ultimate cause of change in African nutrition patterns.” My presentation emphasized the fundamental factors militating against the development of some of the less utilized root crops in Nigeria – yam, cocoyam, cassava and potatoes, which are considered good, cheap sources of energy.

The objective of this study was to assess the extent of production of root and tuber crops in Lagos State, Nigeria, and to advocate the promotion of these crops in order to meet both nutritional and economic needs. The study revealed that the production of root and tuber crops in Lagos State has not received sufficient attention or investment. The conclusion of the study was that small-scale farmers should be provided with the tools and technologies that will help transform root and tuber crops into food security crops, earners of foreign exchange, and vehicles for economic development.

For me, the icing on the cake at FANUS 2015 was the presentation on Implementation Science given by Eva Monterrosa, Scientific Manager at *Sight and Life*. Many nutrition programs have been run in Africa with the aim of achieving optimum nutrition, but numerous of these have not been as effective as they might have been. Implementation Science guides policy-makers, researchers and scientists in the design and scale-up of effective nutrition interventions, and Eva's presentation on the topic was both stimulating and informative.

Acknowledgement

The author gratefully acknowledges the generous financial support of *Sight and Life*, which made it possible for him to participate in FANUS 2015.

Correspondence: Adedotun J Owolabi,

Department of Human Nutrition,

University of Ibadan, Ibadan, Oyo state, Nigeria

E-mail: adedotunowolabi@gmail.com

16 PEACE AND JUSTICE STRONG INSTITUTIONS

.....
Ending malnutrition supports
stable societies
.....



news

What's New?

Did you know? You can now visit the *Sight and Life* website www.sightandlife.org on a regular basis to get the latest news about what is happening in the field of nutrition. Check out our new blog at www.sightandlife.org/blog.html! You can also follow us on **Facebook** and **Twitter @sightandlife**.

01 Perspectives on Seizing the Opportunities for Nutrition in the Post-2015 Development Agenda

Issue 41 of the SCN News complements the articles in this edition of the magazine. Despite the fact that it was published in June, the content is still relevant and very worth reading and reflecting on.

The articles, written from a wide range of perspectives, include content (on subjects ranging from the state of our current food system, through harnessing social protection for nutrition, to critical nutrition indicators) that provides the evidence and support required to continue our advocacy to solve nutrition challenges in the context of embedding them within the SDGs. In his round-up, Ramiro De Silva of the WFP (who has now handed over the responsibility for hosting the SCN to the FAO) reminds us that: “while we must continue to make our voice heard at the global level... we must turn our attention to the effective operationalization of nutrition scale-up in countries.”

In an excellent editorial, Asma Lateef, of Bread for the World, refers to the need to be truly transformative as we move forward.

“In a world where there is enough food, ensuring that all people have access to a nutritious diet is no longer about charity, but about justice.”

Patrick Webb’s article includes a great table that adds supplementary information to the infographic included in this magazine as to the linkages between nutrition and the SDGs.

This information will be really useful, as we now need to talk to a wider audience to ensure more money for nutrition and more nutrition for the money invested.

The newsletter is available for download at

http://unscn.org/files/Publications/SCN_News/SCNNEWS41_web_low_res.pdf

Did You Know?

Every Sunday at noon in St. Peter’s Square, Rome, after praying and giving an inspirational message to the gathered crowd, His Holiness Pope Francis always concludes with the greeting “*Buon pranzo*” (“Have a good lunch”), a deliberate indication of his resolute commitment to promote good nutrition and his dedication to making it a reality at all levels of society and in every region of the world. He has also spoken out in support of breastfeeding, encouraging mothers to breastfeed in church if their children are hungry.

The Pope’s encyclical letter on “Care for Our Common Home” (“*Laudato Si*” – <http://bit.ly/1OhzCwP>) is a recommended read, as is a great article in *The Guardian* by Jason Hickel, an anthropologist at the London School of Economics, who contrasts “*Laudato Si*” with the SDGs that purport to tackle the same challenge (<http://bit.ly/1NKY9r8>).

New Panel on Sustainable Food Systems Launches First Report



The International Panel of Experts on Sustainable Food Systems (IPES-Food), a new independent panel for food systems reform – which is co-chaired by Olivier De Schutter, former UN Special Rapporteur on the right to food, and ex-UNICEF nutrition expert Olivia Yambi, together with 18 experts from various fields connected to food systems – has launched its first report.

Entitled “The New Science of Sustainable Food Systems: Overcoming Barriers to Food Systems Reform,” the report makes the case for reaching beyond the traditional bounds of the scientific community in discussing who holds the power to shape food systems, and who sets the terms of debate when it comes to reforming them. It is timely, as they rightly point out, that: “From persistent undernutrition to burgeoning obesity rates, from land evictions to agriculture’s soaring environmental footprint, from dwindling fish stocks to mounting food waste, there has rarely been so much attention on the problems within food systems.”

As with much in nutrition, it would seem the tendency has been to address the solutions as individual pieces of the puzzle, and to overlook the power relations that play a major role in shaping these systems. The conclusion is clear: “The voices of academic experts and social innovators will be all the more powerful for their ability to talk the same language, and to anchor themselves to common reference points and analytical toolkits.

To learn more about IPES-Food and download the report, please visit www.ipes-food.org

Did You Know?

The term “food system” refers to the web of actors, processes, and interactions involved in growing, processing, distributing, consuming, and disposing of foods, from the provision of inputs and farmer training, through product packaging and marketing, to waste recycling and how these processes interact with one another and with the environmental, social, political and economic context.

Look out for the next edition of the *Sight and Life* magazine, which will be dedicated to food systems and produced in a collaborative effort with the World Food Systems Center at ETH Zurich.

Health & Nutrition Knowledge in the Hands of Those Who Need it Most: Reaching Over 10 Million Girls and Women in India

Mobile technology is here to stay, and one of its growing applications is mHealth – an abbreviation for mobile health, a term that according to Wikipedia is used for the practice of medicine and public health supported by mobile devices. It is an exciting field, and has shown great potential to offer benefits for both nutrition-specific and for nutrition-sensitive interventions, as well as to link the two.

In June 2015, the Indian Academy of Pediatrics (IAP), in partnership with the Ministry of Women and Child Development and UNICEF and with support from Vodafone, launched a nationwide HealthPhone program, becoming the world's largest digital nutrition program. It is expected that by 2018, HealthPhone will have educated over ten million 13–35-year-old girls and women and their families in India on the subject of better health and nutrition practices.

The program will achieve its objectives by widely promoting and distributing through mobile phones four videos on the status of women; the care of pregnant women and children

under two; the importance of breastfeeding and good nutrition; and simple changes in diet and caring practices that can significantly enhance nutrition status. The videos will be available for download for free – and, as a bonus, those that view all four will receive a limited amount of free talk-time. Vodafone will also send out approximately 300 million text messages every year to its 184 million subscribers to encourage viewing of the four videos, and is supporting a comprehensive print and social media communication campaign to promote the program.

It is envisaged that the project will benefit the health of tens of millions of children in India in the years to come and will be truly transformative in educating mothers at the front-line of India's fight against malnutrition.

.....
Watch the videos and learn more at www.healthphone.org.

Did You Know?

.....

GSMA, an association that represents the interests of mobile operators worldwide, uniting nearly 800 operators, is a member of the SUN Business Network and has committed to invest US\$ 3 million in the next five years in mobile nutrition and agriculture advisory services.

Notices



Second International Conference on Nutrition (ICN2) Report

The full report, including the Rome Declaration and the Framework for Action, is now available online in all six official FAO languages.

Please go to: www.fao.org/documents/card/en/c/50ec9968-742f-4fee-a35f-e6f413130a72/

Nutrition Exchange

Nutrition Exchange is an ENN publication that contains short, easy-to-read articles on nutrition program experiences and learning, from countries with a high burden of malnutrition and those that are prone to crisis. It also summarizes research and provides information on guidance, tools and upcoming training courses in nutrition and related sectors.

You can subscribe to the publication or view it on-line at www.ennonline.net/nex.

Society of Implementation Science in Nutrition (SISN) announces Inaugural Board

We are pleased to announce the Inaugural Board (2015–2017) of the Society for Implementation Science in Nutrition. The Board members will lead the Society during the crucial start-up phase, ensuring that the Society delivers on its mission to convene and promote dialogue among scientists, policy leaders, government officials, donors and practitioners. They will act as advocates for the science of implementation, the advancement of research methods, and innovation in knowledge dissemination aimed at improving the design and implementation of nutrition interventions, programs, and policies world-wide.

The Board members serve the Society as volunteers. We recognize their commitment and leadership and wish them every success as they take on the important task of raising the profile of implementation research in the nutrition field.

- > President – **David Pelletier**
- > Vice-President – **Mandana Arabi**
- > Secretary/Treasurer – **Eva Monterrosa**
- > Chief Information Officer & Fundraising – **Luz Maria De-Regil**
- > Councilor: Recruitment, Engagement, Outreach – **Karin Lapping**
- > Councilor: Research Agenda Support – **Marie Ruel**
- > Councilor: Conferences and Policy Discussions – **Rebecca Stoltzfus**
- > Councilor: Continuing Education/Dissemination – **Giles Bergeron**
- > Councilor: At-Large – **Gretel Pelto**

To learn more about SISN, please visit www.implementnutrition.org/

The Chicago Council on Global Affairs welcomes Rajiv Shah

Rajiv Shah, former head of the US Agency for International Development (USAID), has joined The Chicago Council on Global Affairs as a senior advisor to the Council's work in Global Agriculture, Global Cities, and the Global Economy. Raj made seminal progress in reforming the agency during his five-year tenure at USAID, developing signature initiatives to help alleviate hunger and poverty, and advancing the overall effectiveness of US civilian aid around the world, including creating "Feed the Future" and "Power Africa." As the Council aims to address a wide range of global issues, we are sure Raj will make an important contribution, and we wish him well.

For more on the work of the Chicago Council, please visit www.thechicagocouncil.org.



Announcing the Agriculture, Nutrition and Health Academy

The Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH), Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA) and CGIAR's A4NH program have launched an academy intended to act as a platform for learning and sharing, as well as training and capacity building, in agriculture and food systems for improved nutrition and health. The new academy has four objectives: to share innovative research in agriculture and food systems for improved nutrition and health; to stimulate the development and harmonization of new research; to help strengthen the capacity of the research community to undertake inter-sectoral and interdisciplinary research; and to facilitate the uptake of robust evidence in policies and programming in agriculture and food systems for improved nutrition and health. Any researcher working at the intersection of agriculture and food systems, nutrition or health is invited to register to become a member.

.....

For more information or to join, please visit

www.a4nh.cgiar.org/2015/06/19/membership-now-open-anh-academy

.....

Food Fortification Initiative (FFI)

With the world's attention once again focused on food fortification thanks to #FutureFortified, The Food Fortification Initiative has a website that offers numerous resources, including facts and figures, toolkits and latest research. They have recently highlighted the first systematic review of flour fortification on iron and anemia outcomes. Published in Nutrition Reviews, this study makes three recommendations for improving national fortification programs:

1. Design or revise fortification programs so that nutrient levels used in wheat and maize flour fortification are consistent with WHO recommendations;
2. Monitor fortification programs for compliance and coverage; and
3. Use biomarkers specific to the nutrients included in fortification rather than making sole use of anemia to assess the impact of fortification.

.....

You can also sign up to receive their regular newsletters to ensure that you never miss anything important in the field of fortification. Just visit www.ffinetwork.org.

.....

World Hunger Falls to Under 800 Million: Eradication is Next Goal

The State of Food Insecurity in the World 2015 Report once again takes stock of progress made towards achieving MDG1 (Eradicate extreme poverty and hunger) and World Food Summit hunger targets – globally, by region, and by country. The report points out that progress toward ending hunger is assessed not only by measuring undernourishment, or hunger, but also by a second indicator: the prevalence of underweight children under five years of age. Progress for the two indicators across regions and over time is compared, providing insights into the complexity of food security. The report estimates progress to date, defines key success factors, and identifies remaining problems. It also provides guidance on policies that need to be emphasized as we now strive towards SDG 2 (End hunger, achieve food security and improved nutrition) – also known as the “Zero Hunger SDG.”

- > Global hunger has declined. The decline is more pronounced in developing regions, despite significant population growth, and is hindered by countries with slower and less inclusive economic growth.
- > A total of 72 developing countries out of 129 have reached the hunger reduction target. Most have experienced stable political conditions and economic growth, often accompanied by social protection policies targeted at vulnerable population groups.
- > In many countries that have failed to reach the international hunger reduction targets, natural and human-induced disasters or political instability have resulted in protracted crises that have exposed large parts of the population to increased food insecurity.
- > There is a need to improve the quality of diets, hygiene conditions, and access to clean water, particularly for poorer population groups.
- > Social protection directly contributes to the reduction of poverty, hunger and malnutrition by promoting income security and access to better nutrition, health care and education.

“We can look at it as the glass half full or half empty. Seventy-two countries have halved the proportion of hungry people”

Jomo Kwame Sundaram, FAO

The overriding message is that we have made great progress under the MDGs but that there is still much work to be done under the SDGs, which now move us on from addressing food security to addressing nutrition security.

Did You Know?

- > SDG 2 – End hunger, achieve food security and improved nutrition – is also being referred to as #ZeroHunger.
- > The number of hungry people in the world has dropped to 795 million, or around one person in nine, according to the latest edition of the annual UN Hunger Report. This is 216 million fewer than in 1990–92.

Global Nutrition Report 2015



This report has undoubtedly become one of the most important annual nutrition publications. It serves as a report card on the world's nutrition (globally, regionally, and country by country), and outlines efforts to improve it. It assesses countries' progress in meeting global nutrition targets established by the World Health Assembly, and it documents how well countries, aid donors, NGOs, businesses, and others are meeting the commitments they made at the major Nutrition for Growth summit in 2013.

The 2015 report:

- > makes it clear that global progress to reduce malnutrition has been slow and uneven;
- > highlights the critical relationship between climate change and nutrition;
- > highlights the pivotal role business can play in advancing nutrition;
- > considers how countries can build food systems that are more nutrition-friendly and sustainable.

The report also states that nearly half of all countries face multiple serious burdens of malnutrition, and that no country is on track to achieve the global nutrition targets.

To download the report and access a wide range of great information and videos, please go to

<http://globalnutritionreport.org>

Nutritional Health Together with Planetary Health: The Need for Joint Actions



The time has come to recognize the need to also consider planetary health when we discuss human health. This is the message of a thought-provoking report of The Rockefeller Foundation–Lancet Commission on Planetary Health. Planetary health is defined by the Commission as “the achievement of the highest attainable standard of health, well-being, and equity worldwide through judicious attention to the human systems – political, economic, and social – that shape the future of humanity and the Earth’s natural systems that define the safe environmental limits within which humanity can flourish. Simply put, planetary health is the health of human civilization and the state of the natural systems on which it depends.”

The reality is that by almost any measure, human health is better now than at any time in history. Global life expectancy is now 69 years, whereas in the 1950s it was 47 years, and under-5 mortality has also decreased substantially. But, according to the report, these gains in human health have come at a high price: the degradation of nature’s ecological systems on a scale never previously seen in human history.

“The health of humanity is intrinsically linked to the health of the environment – but humanity now threatens to destabilize the Earth’s key life-support systems”

The Commission concludes that the continuing degradation of natural systems threatens to reverse the health gains seen over the last century and proposes that we have mortgaged the health of future generations to realize economic and development gains in the present.

This report comes at an important time, when there is unanimous recognition that to solve the world’s nutrition problems, we need a multi-stakeholder, multi-disciplinary approach. There is now a new urgency to collaborate with an even wider group of players not just to solve nutrition’s challenges but also ensure that in so doing, we don’t add to the Earth’s fragility: “Cooperation will be indispensable for our survival.”

The full report is available at

[www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(15\)60901-1.pdf](http://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(15)60901-1.pdf)

Global Panel Releases New Policy Brief: “Climate-Smart Food Systems for Enhanced Nutrition”



Vegetable stall at a food market in the state of Karnataka, India.

Each decade through to 2050, agricultural output is projected to fall by 2%, while food demand will rise by 14%. By 2100, meanwhile, up to 40% of the world's land surface will have to adapt to altered climates. With statistics like these, it is clear that urgent policy action is needed to link food-system resilience with higher quality diets and nutrition. It is therefore welcome that The Global Panel, an independent group of influential experts with a commitment to tackling global challenges in food and nutrition security, has released a new policy brief entitled “Climate-Smart Food Systems for Enhanced Nutrition.” The policy brief urges decision-makers to adopt a pro-nutrition lens while protecting and promoting agriculture in the face of climate change.

“Climate-Smart Food Systems for Enhanced Nutrition” highlights three key issues. Firstly, we must become more resilient to climate change or better able to address the world's need for improved diets. Secondly, nutrient-rich foods are particularly susceptible to droughts, pests, diseases, and temperature fluctuations. Finally, there is growing evidence that higher levels of carbon dioxide in the atmosphere may reduce the nutrient content and/or quality of various staple crops. This means that climate-smart actions which support nutrition must focus on diverse, high-quality, healthy diets.

The brief recommends six policy actions:

1. Include diet quality goals within adaptation targets proposed for climate action
2. Diversify agricultural investments, factoring in the local realities of ecological suitability and comparative advantage
3. Support greater food system efficiency, so that outputs per unit of water, energy, land and other inputs are optimized and the footprint of agriculture and non-farm activities are better managed to meet both food demand and higher quality diets
4. Integrate measures to improve climate change resilience and nutritional value of crop and livestock products along the value chain, from production to marketing
5. Protect the diet quality of the poor in the face of supply shocks and growing food demand, and
6. Promote the generation and use of rigorous evidence on appropriate investments along food value chains which are resilient to climate change and also deliver positive dietary outcomes and support improved nutrition.

To download the full brief, please go to

www.glopan.org/climate-change

How Food Value Chains Support Nutrition



The panel (from left to right): Gordon Bacon, CEO of Pulse Canada; Charlotte Hebebrand, Director General of the International Fertilizer Industry Association; Klaus Kraemer, Director of *Sight and Life*; Birgit Schleifenbaum, Director Natural & Sustainable Discovery at Firmenich; Martin Bloem, Senior Nutrition Advisor of WFP, Marc Van Ameringen, Executive Director of GAIN and Liz Buckingham, Nutrition and Gender Advisor at the Secretary's Office of Global Food Security, US Department of State.

The SUN Business Network, WFP and GAIN hosted a side event at the 42nd session of the Committee on World Food Security (CFS) in Rome, Italy, in October 2015. The event, entitled “Engaging private sector in nutrition: A look at food value chains and the SUN Business Network,” showcased different value-chain approaches that businesses and their partners are using to support healthier, more nutritious food systems. Panelists discussed utilizing the genetic diversity of germplasm to produce nutritious varieties of pulse crops; micronutrient-enhanced fertilizers to improve yields and combat micronutrient deficiencies; reformulations of food products and fortification during processing; and consumer-based approaches around flavor and taste preferences, nutrition education and social marketing.

“The event highlighted the need to position improved health outcomes for consumers at the center of any agriculture or value-chain-based approach”

The event highlighted the need to position improved health outcomes for consumers at the center of any agriculture or value-chain-based approach, whether it is to combat un-

dernutrition or to reduce overweight and non-communicable diseases. The importance of an enabling environment that fosters innovation, while ensuring affordability and access to nutritious foods among the poor, was also a common theme. At the global level, private-sector investment was also recognized as a significant contribution to financial flows, especially in the face of dwindling official development assistance.

Lastly, building trust was recognized as a prerequisite for working in multi-stakeholder partnerships along the value chain and for finding solutions to the challenges and complexities that arise. Strong partnerships with governments in particular are needed, also acknowledging the important role of the public sector in establishing rules and accountability mechanisms.

Multi-stakeholder platforms like SUN and CFS will provide essential forums for building this trust and increasing awareness of success stories along the value chain moving forward.

Marc Van Ameringen, Executive Director of GAIN, made the welcoming remarks, and the panel was moderated by Martin Bloem, Senior Nutrition Advisor of WFP. It included: Gordon Bacon, CEO of Pulse Canada; Charlotte Hebebrand, Director General of the International Fertilizer Industry Association; Klaus Kraemer, Director of *Sight and Life*; Birgit Schleifenbaum, Director Natural & Sustainable Discovery at Firmenich; and Liz Buckingham, Nutrition and Gender Advisor at the Secretary's Office of Global Food Security, US Department of State.

American Society for Nutrition (ASN) Partners with African Nutrition Graduate Students Network (AGSNet)



ASN and AGSNet are working together to combat malnutrition on the African continent.

The American Society for Nutrition (ASN) has signed a strategic partnership agreement with African Nutrition Graduate Students Network (AGSNet) to work together to combat malnutrition on the African continent. “As a global leader, ASN is ideally positioned to help AGSNet in our joint vision of improved nutrition through education of aspiring health professionals,” said Executive Officer John Courtney.

AGSNet is a network of more than 400 African graduate students and young professionals from more than 30 countries across four continents: Africa, Europe, North America and Asia. It was created by students of Cornell University in Ithaca, New York in 2002. AGSNet’s mission is to create a forum to promote relations and networks, build appropriate attitudes and values among its members, nurture leadership capacities, and present a unified front to improve nutrition on the African continent. ASN’s more than 5,000 members work in diverse areas of nutrition and are located in more than 65 countries. Through the highest-rated nutrition research and practice, ASN’s members enhance scientific knowledge, promote science-based messages, and ultimately seek to enhance quality of life.

“AGSNet is undergoing a transformation to meet the network’s objectives within current global circumstances,” says Joseph Ashong, AGSNet Coordinator. At the core of the transformation is the opportunity to bring to the forefront the critical role of African graduate students and young professional in the “fight” against malnutrition on the African continent. “The partnership between ASN and AGSNet is a key part of the transformation,” notes Brenda Ariba Zarhari Abu, AGSNet Steering Committee.

Under this strategic partnership, ASN and AGSNet will collaborate in five focal areas:

- > **Leadership and mentorship:** AGSNet leadership will benefit from a strong relationship with ASN and their Global Nutrition Council and learn from ASN experience in providing strong organizational leadership
- > **Improved Networking Opportunities:** AGSNet will work closely with Cornell, Wageningen and ASN to plan, raise funds and implement conferences and other programs to meet, network and discuss issues important to AGSNet and African nutrition matters
- > **Access to publications and journals:** AGSNet and ASN will encourage publications and improved research output from AGSNet and collaborate to provide access to ASN articles and journals and build the capacity of AGSNet members to publish in the highest global impact nutrition journals
- > **Website Hosting:** ASN will host AGSNet website and provide technical assistance on the management of the website
- > **Financial Management and Fund Raising:** AGSNet will benefit from ASN’s experience in managing accounts and sourcing for funds, and from its network of funding agencies and sponsors.

“ASN enters this partnership with the goal of improving health and nutrition in Africa and beyond through the expertise and training of our members and leaders,” comments ASN President Patrick J Stover. “As founding institutions, Cornell and Wageningen Universities will continue to have an important role in mentoring and guiding AGSNet leadership,” adds Fré Pepping of Wageningen University.

For further information on the activities of AGSNet, please contact *Joseph Ashong* (joashong@gmail.com; twitter handle: [@joashong](https://twitter.com/joashong)) or *Brenda Ariba Zarhari Abu* (abubrenda@yahoo.com).

For further information on ASN, please contact *Mary Pat Cornett* (mpcornett@nutrition.org).

Scaling Up Nutrition (SUN) Global Gathering 2015



Tom Arnold, interim coordinator of the Scaling Up Nutrition (SUN Movement): “The nutrition community has really come together in the past few years to agree core agendas.”

The three-day annual SUN Global Gathering is an event that has become more like an ever-expanding family reunion than a meeting. With 56 countries and the Indian State of Maharashtra having joined in just five years and the Executive Committee now established, this is without doubt the biggest forward shift in nutrition we have yet seen. These are the countries that are taking nutrition seriously. They recognize that nutrition has to be at the center of their development plans across government sectors, with multi-sectoral actions right down to the lowest district/community level, where true implementation happens and statistics have names and faces. These are countries that are prepared to be scrutinized, having to show their progress in the SUN Annual Report each year. The progress in the 2015 Report (available on the SUN website) shows that with the right level of commitment and investment, significant reductions in malnutrition can, and are, being achieved.

“Defeating malnutrition is no longer an abstract aspiration: it is the new normal”

The global gathering offers a wonderful opportunity to share experiences (positive and negative), and there is an amazing energy and passion that makes one optimistic that the movement will continue to grow



and deliver real results. The main sessions addressed progress and achievements; more nutrition for the money and more money for nutrition; empowering women and girls across the movement; making accountability relevant for people's nutrition; and looking ahead – ambitions for the future of the SUN Movement. **Most of the main sessions are available as webcasts on the SUN website**

(<http://scalingupnutrition.org/about/annual-global-gathering/global-gathering-2015>).

Plenaries were combined with workshop sessions that enabled deeper analysis and included time for good discussion, and Twitter was abuzz with sharing comments and thoughts. There was a loud call to leverage parliamentarians for nutrition, as they can create the noise to bring about change. But the challenges they face involve breaking down the messages into “What does it mean for me?”; having the right information and data at the right time and in the right format; and receiving training on what they should be advocating. In the words of one vocal parliamentarian, “You must give us fire for our passion, but as clear messages in a language we understand.”

We identified six key needs during the meeting that are critical for acceleration and action.

1. We must consolidate what works best from what we have learnt to date, and we must continually innovate – business as usual will not work!
2. Issues of justice and equity must be addressed, especially when it comes to women and their access to essential health services and information.
3. There is a need to provide more and better-quality data, from more sectors (e.g., agriculture, social protection), but already existing data should also be better used and communicated.
4. It is time for the scientists to learn to speak to other audiences and provide them with appropriate information to empower them to champion change.
5. Financial tracking is essential, but it must be recorded, updated and transparent.
6. The move must be to implementation, supported by functional and leadership capacity development.

In closing, Ertharin Cousin, Executive Director of the World Food Programme, gave a rousing address and urged the group that: “We cannot take our foot off the pedal ... There can be no peace and security without food and nutrition security ... We must give nutrition a voice at every level ... We must have patience ... We have been inspirational and yet we have to have even greater aspirations and set ourselves stretch targets ... We cannot give up, and we must not fail.”

SUN 2015 Global Gathering take-away messages from David Nabarro, UN Secretary-General's Special Representative for Food Security and Nutrition

- > We can't get anywhere without nutrition champions at all levels.
- > We can't get anywhere without local action.
- > Resources (human and financial) are essential.
- > Civil society is key for action and accountability.
- > Results must be measured against a framework.
- > We have to be inclusive.
- > Business must be engaged but within the bounds of the principles SUN has agreed to.
- > The support of academia is definitely needed.
- > Women must be at the center, but men have to help make it happen.
- > There are clouds on the horizon that could undo the progress being made – war, natural disasters, climate change.
- > Nutrition must be institutionalized and not be a political trend.
- > Resilience is key, but must be rooted in mutual accountability.
- > We cannot fail. We will not fail, as success is in our collective hands.

Celebrating Dedicated Leadership in Nutrition: Shawn Baker Wins 2015 *Sight and Life* Nutrition Leadership Award



Shawn Baker (right) receives the 2015 *Sight and Life* Nutrition Leadership Award from Klaus Kraemer.

It has become a tradition that *Sight and Life* hosts an event during the SUN Global Gathering to celebrate and acknowledge an individual who, during the course of his or her career and current work, promotes both implementation science and change leadership in moving nutrition forward. The 2015 award winner is Shawn Baker from the Bill & Melinda Gates Foundation. In presenting the award, *Sight and Life's* Klaus Kraemer said: "As Director of Nutrition at BMGF, Shawn has guided the development of the foundation's comprehensive nutrition strategy and has become a powerful and eloquent voice for nutrition."

Before joining the Bill & Melinda Gates Foundation, Shawn was for many years with Helen Keller International, where he shaped programs that provided more than 50 million children with life-saving vitamin A supplements. He is also a champion of food fortification, recently saying: "We have an invisible problem (hidden hunger) that has an invisible solution (food fortification) that we now have to put center stage and make the proven benefits very visible."

Shawn is a highly deserving recipient of the 2015 *Sight and Life* Nutrition Leadership Award.

We offer him our warm congratulations!

**"We urgently need the voice of
Shawn Baker as we ensure that
SDG 2 is given the attention required
to change the world in our lifetime"**

#FutureFortified Global Summit on Food Fortification – Arusha, Tanzania, September 9–11, 2015

Food fortification has long been recognized as an evidence-based and highly effective means to deliver sustainable impact to improve micronutrient status and therefore public health. As countries continue to sign up to the SUN Movement, and grow their commitment to nutrition through initiating proven interventions, it was appropriate to once again place food fortification in the spotlight.

The Global Alliance for Improved Nutrition (GAIN) and the Government of Tanzania hosted a summit that was co-convened by BMGF, USAID, UNICEF, WFP, the AUC, and SUN and was supported by a Technical Advisory Group made up of members of organizations that have been involved in the field of fortification for numerous years and included *Sight and Life*, Micronutrient Initiative, Helen Keller International, FFI, IGN, FHI360/FANTA, Micronutrient Forum, PATH, PHC, Smarter Futures, CDC Impact and ETH.

Unique was that the summit also had a media partner in the form of Devex, a platform for the global development community. An impressive 450 delegates from 57 countries, including 29 developing country delegations, as well as leaders from business, academia and international organizations attended.

The summit was an excellent platform for networking and achieved its three goals.

1. Review achievements, challenges and lessons learnt:

The Summit examined contextual factors which drive reach, impact and sustainability, with eleven countries presenting their fortification stories.

2. Understand current evidence: The event looked at the latest evidence-informed guidelines as well as systematic reviews on health and nutrition impact and their implications for improving programming.

3. Align on the way forward: The Summit culminated in the Arusha Statement on Food Fortification which outlines the major priorities moving forward. This makes five recommendations to ensure that food fortification programs are expanded, improved and sustained in low- and middle-income countries.

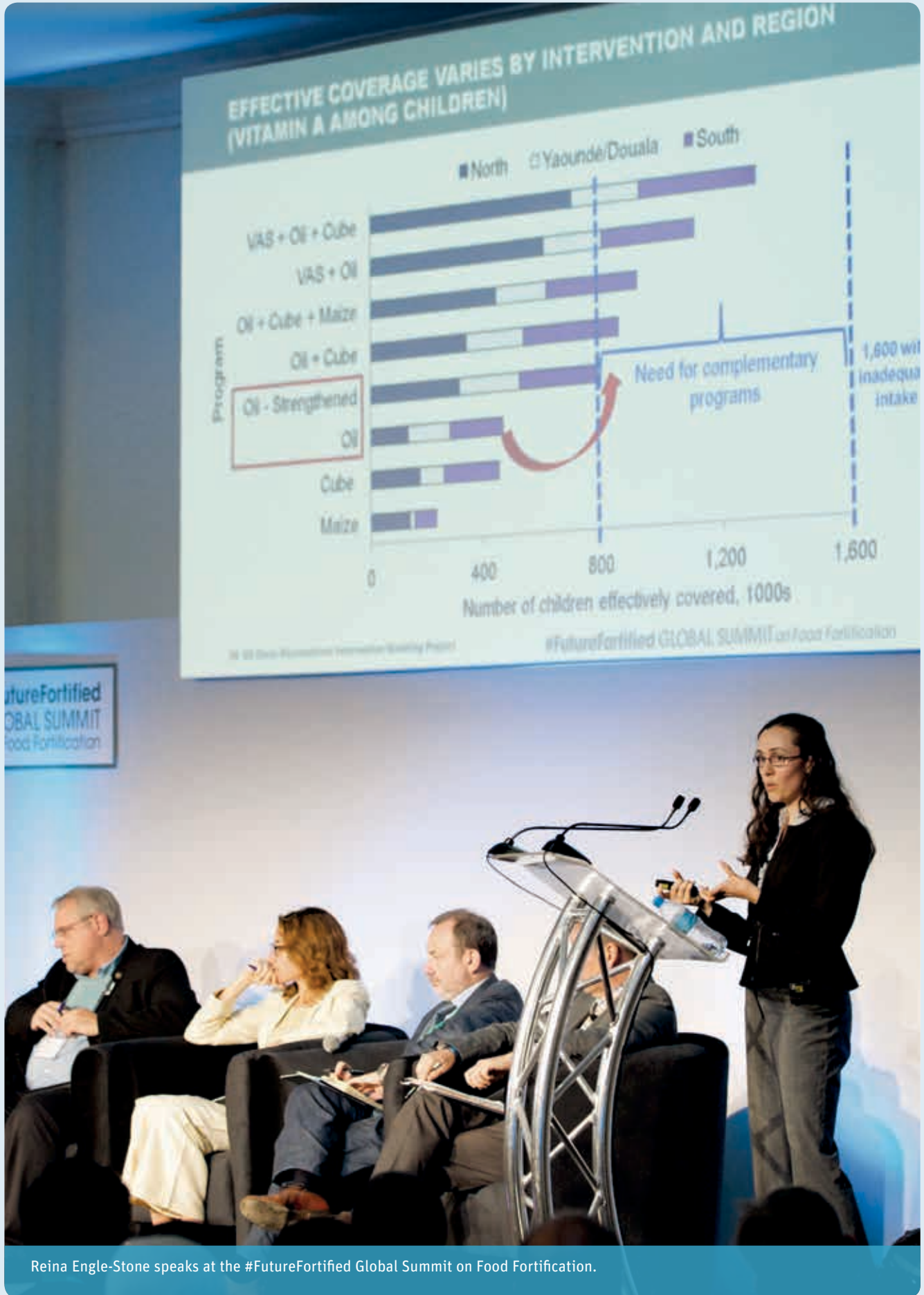
There were over 70 presentations during the summit. Most of these were designed to educate newcomers to the fortification discussion, update those who have not kept abreast of the scientific developments in fortification, and inspire politicians that fortification is the right intervention in which to invest.

Some valuable videos are available at <https://pages.devex.com/future-fortified.html>.

A major part of the #FutureFortified campaign was, and continues to be, an extensive communications strategy that began four months before the event and included a social media thunderclap that reached an audience of 826,333. There were also more than 1,300 tweets using #FutureFortified during the 3 days of the summit, with a total 2.4 million impressions. If you are on Twitter, make sure to follow @FutureFortified to keep up to date with developments. This was not intended to be a one-off event, but the start of concerted actions to keep food fortification moving forward toward addressing hidden hunger – after all, 2 billion people still do not receive the nutrition they need for optimal growth and health.

GAIN is now leading a process with over 20 fortification partners from the #FutureFortified Technical Advisory Group to elaborate on the Summit recommendations by the end of January 2016. This will include a final report laying out a multi-partner strategy for continued global advocacy; a roadmap for establishing an annual report and/or an observatory for fortification and a related global fortification meeting; and specific guidance on each of the five recommendations of the Summit Statement.

Sight and Life was proud to be one the partners for this event – which, for the first time, created a sector-wide analytical framework and consensus on evidence gaps, delivery models and pathways for fortification. #FutureFortified has undoubtedly reinvigorated interest and awareness and as a result hopefully also investment and innovation in food fortification. In the words of Chris Elias, President of the Global Development Program of the BMGF, “*Innovation will be part of driving our success over the next 15 years, but a good place to start is with scaling up what we already have.*”



Reina Engle-Stone speaks at the #FutureFortified Global Summit on Food Fortification.

Developmental Origins of Health and Disease (DOHaD) Congress



Jane Badham (Session Chair), Philip James (Speaker), Parul Christian (Speaker), Klaus Kraemer (*Sight and Life* Co-host and Speaker), Sara Wuehler (Micronutrient Initiative Co-host).

While some 159 million under-five-year-olds remain stunted, 42 million were overweight in 2013, and the last 30 years has seen a doubling of obesity amongst adults. Is there a link? What might be at the core of these global challenges?

A poor start to life is associated with an increased risk of a number of disorders, especially non-communicable diseases (including cardiovascular disease, obesity, type 2 diabetes and metabolic disturbances, osteoporosis, chronic obstructive lung disease, some forms of cancer, and mental illnesses) in later life. The DOHaD concept describes how during early life (conception, pregnancy, infancy and childhood) the interplay between maternal and environmental factors program fetal and child growth and development that have long-term consequences on later health and disease risks. Timely interventions may reduce such risk exposure in individuals and also limit the transmission of non-communicable diseases to the next generation. DOHaD research has substantial implications for many transitioning African societies, as well as for global health policy.

The 9th DOHaD meeting was held in Cape Town, South Africa from November 8–11, 2015 and brought together a

wonderfully diverse group of over 830 scientists, clinical researchers, obstetricians, pediatricians, public health professionals and policy leaders from around the world. The attendance illustrates that DOHaD is becoming increasingly important. The program for the meeting was designed to address, head-on, the many challenges that currently impact the health of mothers, babies in the womb, infants, children and adolescents, as well as to explore solutions, interventions and policies to optimize health across the life course.

The over 130 presentations and almost 400 posters shared fascinating research findings across a wide range of DOHaD topics and showcased the number of projects that are being undertaken in this field of research. Yet it is complex: what you measure, when you measure it, and what you compare it against are all critical, and could still result in different messages. It was also clear that, while much of the research being done holds promise, there is a need to test with actual interventions – the move from efficacy and effectiveness to implementation research.

Key themes are emerging, including the growing concern and possible early-life links around ever-increasing obesity

levels and the recognition that, although the first 1,000 days is critical, childhood, adolescence and pre-conception must not be neglected. Neither must the role of men be forgotten.

Sight and Life, together with the Micronutrient Initiative, hosted a session entitled “DOHaD and nutrition: Are we doing enough to improve birth and long-term outcomes through maternal nutrition?” There were three presenters: Parul Christian from Johns Hopkins Bloomberg School of Public Health on “Maternal nutritional status and micronutrient deficiencies – Impact of interventions on birth outcomes and long term consequences”; Philip James from the London School of Hygiene and Tropical Medicine on “Can what a mother eats at the time of conception influence the epigenome of her child? A review of potential nutrition-epigenetic pathways and latest studies from The Gambia”; Klaus Kraemer from *Sight and Life* on “Policy and program implications for multiple micronutrients in pregnancy – Where do we stand and where should we be going?”

The presentations were followed by an interactive discussion with the presenters and the attendees. The session highlighted the importance of considering interventions in combination, rather than as independent of one another, as multiple nutrient deficiencies are generally found in undernourished settings. By doing so, we may begin to see the additive effects of providing a comprehensive package of interventions to vulnerable pregnant women, rather than the beneficial, but perhaps limited, effects of isolated interventions. Of relevance for DOHaD is that in order to gain a greater understanding of the associations between pregnancy, nutrition, and health risks across the life course, preconception and antenatal interventions need more and longer-term follow-up, particularly in low- and middle-income undernourished and transitioning populations.

If you would like to explore some of the discussions that took place, a fabulous feature of the congress was a daily newsletter that gave insight into the previous day’s sessions.

.....
The daily newsletters are available on the website at

<http://dohad2015.org>.

.....

Editor's note: This section contains reviews of books, publications, and websites that, whether brand new or classic, we hope will be of interest to our readers. Notices of relevant new publications that do not actually constitute reviews will from henceforth be published on www.sightandlife.org.

Book Review

Food Security and Scarcity: Why ending hunger is so hard

C Peter Timmer

University of Pennsylvania Press 2015

Format: Hardcover

Length: 240 pages

ISBN-10: 0812246667

ISBN-13: 978-0812246667

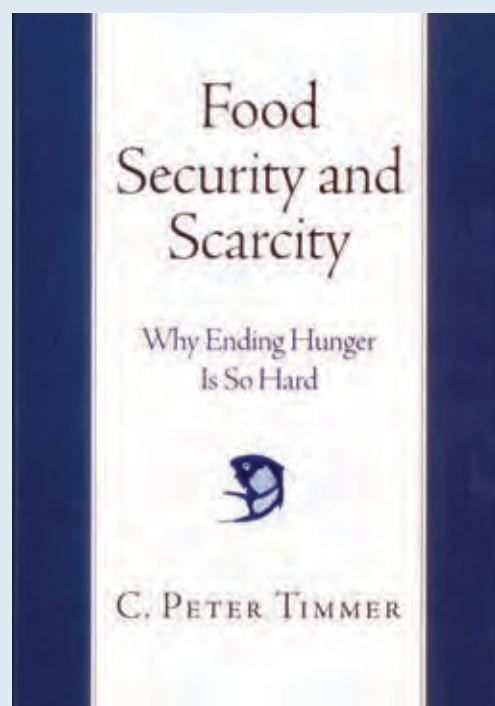
“Happy families are alike,” wrote Leo Tolstoy; “every unhappy family is unhappy in its own way.” Thus one of the greatest poets of human unhappiness commenced one of the greatest novels of all time, *Anna Karenina* – and readers have ever since debated the truth or untruth of this deceptively simple antithesis. C Peter Timmer might possibly agree with Tolstoy’s pronouncement on the human condition, for one of the fundamental tenets of his latest publication is that poverty and hunger are different in every country, and so the manner of coping with the challenges of ending hunger and keeping it at bay will depend on equally country-specific analysis, governance, and solutions.

Food Security and Scarcity: Why ending hunger is so hard, as its author explains in the Preface, “draws on well over three decades of thinking about food security and the difficulty in achieving it. Even in the wake of the world food crisis in the mid-1970s,” Timmer continues, “it was obvious that the problem was not the total amount of food produced, but the access of poor households to that food ...” This is because, in Timmer’s view, “More food does not guarantee greater food security.”

Timmer argues that “food security is determined by how much food households consume, not by how much they produce.” His strong conviction is that markets have a critical influence on decision-making about food consumption and production, and thus absolutely have to be taken into account by the politicians, policy-makers and planners who are responsible for improving food security.

“Food security is determined by how much food households consume, not by how much they produce”

Markets have no conscience, however, and their workings are not designed to deliver such things as public health, education or social security. Markets are not designed at all, in fact: they are abstract systems, and extremely self-serving.



Their energy can be channeled, however, if their workings are understood and their potential recognized. “Ending hunger,” argues Timmer, “requires that each society find the right mix of market forces and government interventions to drive a process of economic growth that reaches the poor and ensures that food supplies are readily, and reliably, available and accessible even to the poorest households.”

Timmer goes on to explain the challenges of putting this proposition into practice. The emphasis is on a plurality of approaches here. “[Ensuring food security] takes sustained economic growth that systematically includes the poor, along with public actions to stabilize the food economy in which poor households live,” he states. In the context of the SDGs and the growing dimensions and influence of the SUN Movement, it is interesting that he argues so forcefully against one-size-fits all global solutions. “There is no shortage of proposals to improve food security and reduce poverty,” he observes, but: “The most useful ones are regional or even country-specific.”

Timmer argues that the main arenas in which changes are necessary are as follows:

- > Higher productivity for smallholder farmers;
- > A dynamic rural economy with rising real wages, stabilized by a concern for volatile food prices;
- > Design and funding of safety nets that protect the vulnerable from chronic poverty and a volatile economic environment; and

- > Support for the regional (and global) public goods that will be essential going forward to sustain adequate food supplies, access to that food, and adequate nutritional outcomes in households.

Rural productivity and economic growth provide the ingredients for food security, in Timmer’s opinion, but only societies with political determination, good governance, and effective policy are capable of ending hunger. The struggle itself will take a different form in each country. But the 20th century – to which Tolstoy and many of his contemporary intellectuals looked forward with such eagerness – was littered with failed utopias and collectivist plans that delivered famine and death. The market is not the solution, but it certainly has to be part of the solution, as Peter Timmer makes clear in this excellent book.

.....
Review by: *Jonathan Steffen*

Email: *jonathan.steffen@corporatestory.co.uk*

.....
“Food Security and Scarcity: Why ending hunger is so hard” is available from University of Pennsylvania Press

.....
Sight and Life endorses a holistic approach that embraces both food security and nutrition security as the basis for ensuring the long-term well-being and prosperity of societies (Ed.)

.....

Imprint

Sight and Life Magazine

Incorporating the Xerophthalmia Club Bulletin and the Nutriview Newsletter

Publisher: *Sight and Life*

Editor: Klaus Kraemer

Editorial team:

Anne-Catherine Frey,
Svenia Sayer-Ruehmann,
Jane Badham,
Kalpana Beesabathuni,
Eva Monterrosa

Communication consultancy and text writing:

Jonathan Steffen Limited,
Cambridge, United Kingdom

Design concept, layout, and graphics:

S1 Communication Design,
Augsburg, Germany

Proofing:

transparent Language
Solutions, Berlin, Germany

Printer: Burger Druck,
Waldkirch, Germany

Opinions, compilations, and figures contained in the signed articles do not necessarily represent the point of view of *Sight and Life* and are solely the responsibility of the authors.

Credits:

Cover, Page 11, 59, 94, 109, 110:

Mike Bloem Photography

Page 15 (left):

Stephen Kodish

Page 15 (right):

Pragya Mathema

Page 17:

Bandim Health Project

Page 24: Dr. Harold Furr

Page 26: Adapted from dela Sena et al.2013, ref #22

Page 28: Adapted from Eroglu et al. 2012, ref 39

Page 36: Sprinkles Global Health Initiative

Page 40: ©Bachrach

Page 43: Dar es Salaam State House Photo

Pages 50, 52: Johann Jerling

Page 65:

PS Rao/HarvestPlus

Page 66: HarvestPlus

Pages 68, 69: GAIN

Page 73: Dante Marese

Page 74:

Andrew Hegarty, IIEA

Page 83, 85, 86:

© Benjamin Rakotoarisoa

Page 88:

Harold James Doroteo

Pages 91–93:

The Micronutrient Initiative

Pages 99–100:

Adedotun Owolabi

Page 111: FAO/Giorgio

Cosulich de Pecine

Page 113:

SUN Movement Secretariat

Page 117:

GAIN/©Ben Fisher

Sight and Life

Klaus Kraemer

Director

PO Box 2116

4002 Basel, Switzerland

Phone: +41 (0) 61 815 8756

Fax: +41 (0) 61 815 8190

E-mail: info@sightandlife.org

www.sightandlife.org



Sight and Life

is a nutrition think tank supported by DSM

ISBN 978-3-906412-80-1



Carbon-neutral production



Disclaimer

You are free to share, including to copy, distribute and transmit the work to Remix; adapt the work; and make commercial use of the work, under the following conditions. You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work).

.....
“Attribute this work” means that the page you came from contained embedded licensing metadata, including how the creator wishes to be attributed for re-use. You can use the HTML here to cite the work. Doing so will also include metadata on your page, so that others can find the original work as well.

Waiver

This is based on the understanding that any of the above conditions can be waived if you obtain permission from the copyright holder.

.....

Public domain

Where the work or any of its elements are in the public domain under the applicable law, that status is in no way affected by the license.

.....

Other rights

In no way are any of the following rights affected by the license: your fair dealing or fair use rights, or other applicable copyright exceptions and limitations; the author’s moral rights; and the rights other persons may have either in the work itself or in how the work is used, such as publicity or privacy rights.

Notice

For any reuse or distribution, you must make clear to others the license terms of this work. The best way to do this is with a link to this web page:

<http://creativecommons.org/licenses/?lang=en>



A world free from malnutrition.



Sight and Life is a humanitarian think tank. Inspired by a vision of a world that is free from malnutrition, it helps to improve the lives of some of the world's most vulnerable populations. It does this by supporting innovation that aims to eradicate malnutrition.