



Turning Rapid Growth into Meaningful Growth: Sustaining the Commitment to Nutrition in Zambia

Edited by Jody Harris, Lawrence Haddad and Silke Seco Grütz

Cover photograph Zambia, Kankoyo, Mufulira. A child swings from a set of goalposts on a football pitch on rough ground beside the Mopani Copper Mine.

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Foreword

In June 2013 the Zambian government pledged to cut chronic malnutrition in the country by half over the next ten years. This is in recognition of the serious threat that malnutrition poses to child survival, child health, maternal health, school achievement and productivity in the labour market. The opportunity for reducing stunting rates is clear. We know what to do about it and the government, as signalled by its membership of the Scaling Up Nutrition (SUN) movement, is committed to doing it.

The articles in this *IDS Special Collection* are from Zambians and from those who work in Zambia and as such put national voices, knowledge and know-how at the forefront of the collection, all within the context of a wider set of international perspectives and experiences. The articles describe the nutrition trends in the country, highlight some of the factors shaping those trends, and identify and analyse some of the efforts to improve nutrition status, and draw out some of the bottlenecks –

financial, capacity and knowledge-based – that will need to be addressed if progress is not to be stalled. The articles serve as a guide to action but also as a rallying cry for sustained commitment, not simply from the government, but from all parts of Zambian society – academics, NGOs, community-based organisations, the media, businesses and international development partners.

As this report notes, Zambia is on the cusp of a great economic boom. By investing more of the growing tax revenue stream into undernutrition-reducing efforts, economic growth can be made more sustainable and more transformative. Investing in the most vulnerable members of our society – children under the age of two and their mothers – is a sure-fire way of turning fast economic growth into more meaningful growth, both economic and human.

Guy Scott
Vice President of the Republic of Zambia



Introduction – Turning Rapid Growth into Meaningful Growth: Sustaining the Commitment to Nutrition in Zambia*

Jody Harris, Silke Seco Grütz, Cassim Masi and Lawrence Haddad

Abstract Zambia suffers high levels of child stunting and is struggling to achieve the nutrition-related MDGs, with significant constraints in the provision of services to address every one of the underlying determinants of undernutrition. Motivated by increasing advocacy for nutrition under the Scaling Up Nutrition (SUN) movement, the Zambian government pledged in June 2013 to cut chronic malnutrition by half over the next ten years. The country has come some way recently in creating coherent policies and strategies for nutrition, and has had some notable successes. However, important challenges remain, not least in coordination, capacity, finances and evidence. This article argues that if these challenges are to be met, political attention is not enough. Sustained focus and country ownership are needed to implement the necessary nutrition programmes across sectors, and real political and system commitment to reducing the number of malnourished children in Zambia is required in order to translate recent interest into impact.

1 Introduction

The level of undernutrition in Zambia is high and persistent. The increasing commitment of Zambian and international stakeholders to changing this situation holds out the prospect of real declines in undernutrition over the coming years. In addition, the current strong growth of GDP per capita is potentially a positive driver of future undernutrition declines. Despite these increased opportunities for undernutrition reduction, however, there are several real threats to progress. Based on a combination of research evidence and long experience of working in the country, the authors in this *IDS Special Collection* describe some of these opportunities and threats in Zambia and suggests ways of seizing the former and dealing with the latter.

This article is intended to provide an overview of undernutrition in Zambia and research and action being undertaken to tackle it. First, the article summarises the nutrition situation in Zambia. Second, we describe the current promising context for malnutrition reduction, focusing on government commitments, partner support and the growing economy. Third, drawing on the articles in this *IDS Special Collection*, we highlight some of the nutrition-relevant actions that seem to be reducing undernutrition. Fourth, we identify some of the key risks for future progress and draw out implications for action. Finally, we identify knowledge gaps where more evidence is needed if opportunities are to be seized, risks minimised and undernutrition reduction accelerated.

2 Nutrition in Zambia

The major nutritional problem in Zambia is child stunting (low height-for-age). With 45 per cent of children under five stunted (including 21 per cent severely stunted) (CSO *et al.* 2009), short stature is commonly perceived as the norm rather than the result of chronic undernutrition. While there are some signs that rates of stunting have

declined in recent years (from a high of 58 per cent in a 1999 Multiple Indicator Cluster Survey (MICS) to 45 per cent in the most recent Demographic and Health Survey (DHS)), over the long term, rates are little changed (46 per cent in the 1992 DHS, for example). Stunting rates reach 33 per cent even in the upper income quintile, which suggests that while we do not have to fix inequality before we reduce stunting, if we want to reduce stunting for the poorest populations we have to do it deliberately with nutrition programming, and systematically address underlying determinants of undernutrition (UNICEF 2013).

Stunting rates are significant even in newborns, increase dramatically to around age two and remain high through childhood and beyond (CSO *et al.* 2009). The level of stunting is linked to size at birth, so attention to nutrition in-utero is important. The first 1,000 days from conception to age two are known to be critical in prevention of stunting (Black *et al.* 2013) and are now the focus for most nutrition programmes. Other key nutrition indicators are also poor: rates of underweight (weight-for-age) and acute malnutrition or wasting (weight-for-height) are little changed at 15 per cent and 5 per cent respectively (CSO *et al.* 2009). Underweight is also a nutritional problem in women, with 9.6 per cent of women moderately or severely thin for their height; but twice that number are now overweight (19.2 per cent), reflecting a changing pattern of food consumption, particularly in urban areas where 29.6 per cent of women are overweight or obese (CSO *et al.* 2009).

Micronutrient malnutrition had not been measured in Zambia for decades at a population level, until a survey in 2013 to assess vitamin A, iron, zinc and vitamin B12 status of women and children in two provinces (NFNC 2013). Micronutrient deficiencies were found to be high: 15 per cent of children under five are zinc deficient, 20 per cent

are vitamin A deficient (though this appears to have reduced by almost 50 per cent in a decade), 21 per cent are iron deficient (with 56 per cent anaemic), and 87 per cent are deficient in vitamin B12. In women, iron deficiency and anaemia rates are high, especially during pregnancy, at 19 per cent and 42 per cent, respectively; zinc deficiency is also high but varied significantly between provinces at 28–70 per cent; and 95 per cent of women are deficient in vitamin B12.

3 Prospects for undernutrition reduction

Two factors are common to most documented sustained reductions in undernutrition: broad-based economic growth and wisely allocated increases in resources for nutrition-specific and nutrition-sensitive programmes (e.g. Haddad *et al.* 2014 for Maharashtra; Headey *et al.* 2014 for Bangladesh; O'Donnell *et al.* 2009 for Vietnam; and Monteiro *et al.* 2009 for Brazil).

The Zambian economy, bolstered by mining revenues and therefore linked to international mineral prices, is currently strong; GDP is growing fast, at around 5–7 per cent per year for the past six to seven years, and in 2012 the World Bank declared the country 'middle-income' (World Bank 2012). However, this growth is highly uneven: while urban poverty has dropped significantly over the past 20 years (40 per cent to 26 per cent since 1996) and there is an affluent and growing middle class in the country, rural poverty is unchanged (at around 78 per cent, with signs that this is worsening in some rural pockets), and the share of income captured by the bottom fifth of the population low and stagnant (3.6 per cent since 2004, one of the lowest figures in sub-Saharan Africa) (World Bank 2014b). Inequality is therefore an urgent problem in Zambia, and helps explain why overall income growth does not quickly translate into poverty reduction. This makes it even more important that there is a good nutrition strategy in place; efforts to reduce chronic undernutrition are not getting as much help from general economic growth as they would be in many other contexts. It also makes it imperative that nutrition scale-up is inclusive of those at all levels, particularly the most nutritionally and economically vulnerable, because equity is not built into the structure of the economy.

A precursor for wisely allocated increases in nutrition spending is increasing commitment from Zambian stakeholders to undernutrition reduction. The trend here is promising; for example, in June 2013 the Zambian government pledged to cut high levels of chronic malnutrition in the country by 50 per cent over a period of ten years to 2023. The statement was made by the Vice President of the Republic Guy Scott in front of a global audience at the Nutrition for Growth conference in the UK (Nutrition for Growth 2013). Specifically, the government pledged to fill human resource and financial gaps for nutrition in key line ministries;¹ increase government nutrition expenditure to US\$30 per child under five, including a minimum 20 per cent annual budget increase; encourage private sector involvement in production of nutritious foods; and strengthen government governance and coordination mechanisms, including direct oversight by the Vice President and strengthening of the National Food and Nutrition Commission (NFNC)

(Nutrition for Growth 2013). This is an ambitious agenda, but one that addresses many key challenges identified in and by the country.

This important government pledge came after two years of increasing advocacy for nutrition following the signing of Zambia as an 'early riser' country to the SUN (Scaling Up Nutrition) movement in early 2011, seen as a sea-change for nutrition for the country. However, building and sustaining commitment is not a quick-win, and improving and implementing policies and laws is an ongoing process. Pre-2011, Zambia did not score well on various indices constructed to measure nutrition commitment and governance, ranking mid-to-end of various lists assessing national policy commitment and governance (Engesveen *et al.* 2009); the legal framework and undernutrition situation (ActionAid 2010); and an index derived from legal frameworks, government expenditure, and policies and programmes (te Lintelo *et al.* 2013). Nor did Zambia fare well in two governance studies assessing intersectoral coordination and resourcing for nutrition, both of which were found to be inadequately addressed (Taylor 2012; Harris and Drimie 2012). In sum, Zambia has a favourable economic outlook, and nutrition is attracting much attention internationally which appears to have translated into attention from the national government. But it is known that attention, even from high-level politicians, is insufficient to drive action; real political and system commitment is necessary to translate interest into impact (Pelletier *et al.* 2011).

4 Nutrition-relevant actions that appear to be effective

Here we draw on the articles in this *IDS Special Collection* as well as previously published research. We use the phrase 'appear to be effective' because while many of the initiatives described seem to have positive effects, very few of them have been subjected to rigorous impact evaluations, a point we return to later in this article.

In the past, Zambian nutrition policy has been described as 'essentially wish-lists noting best practice, confined mainly to the health sector, created with substantial input from external actors, and without the backing of political commitment, budgetary or human resources, or capacity' (Harris and Drimie 2012). However, Zambia has come some way over the past three years in creating coherent policies and strategies for nutrition, and does have some notable successes in policy interventions (noted in the following sections), particularly in micronutrient nutrition; integration of nutrition actions into the policies of sectors other than health is slower, but there are signs of tentative action.

Government attention to reducing malnutrition in Zambia dates back to 1967, when the NFNC was established as a statutory Board through the National Food and Nutrition Act. This Act recognises the right to good nutrition and nutrition services, and mandates the NFNC to promote food and nutrition activities and to advise the government accordingly. The Act of 1967 was amended in 1975 to include provision for the set-up of community nutrition groups and their registration with the NFNC, and plans are under way in collaboration with the World Bank for a further revision aimed at strengthening the NFNC, which may place it under the Office of the Vice President.

Nutrition is recognised in overarching development policies and strategies such as the 2002 Poverty Reduction Strategy Paper (PRSP), Zambia's 'Vision 2030', and the Sixth National Development Plan (mostly identifying nutrition as an important input into social and economic development). A series of nutrition policy and planning documents has emerged from these strategies (Harris and Drimie 2012). The 2006 National Food and Nutrition Policy (NFNP) articulates a policy framework built upon the nutrition gaps highlighted in the PRSP, with a vision of achievement of optimal nutritional status for the Zambian population, and recognition of food and nutrition security as a right. To operationalise the NFNP, the National Food and Nutrition Strategic Plan 2011–15 (NFNSP) takes a multisectoral focus on child stunting and the first 1,000 days, and articulates programme components including communications, advocacy and a monitoring and evaluation framework.

4.1 First 1000 Most Critical Days Programme

Recognising that funding the full NFNSP would be a challenge, attention was focused on one key aspect of the Plan. In April 2013, Zambia officially launched the NFNSP together with the First 1000 Most Critical Days Programme (MCDP) under the leadership of the NFNC and the Ministry of Community Development Mother and Child Health (MCDMCH, identified as the lead implementing ministry) with substantial input and support from the international community.

The MCDP is a national programme and has received endorsement by the ministers of each of the five key line ministries. In essence, the MCDP operationalises the multi-sector Strategic Direction 1 of the NFNSP that focuses on the first 1,000 days of life. The programme is organised under five strategic areas: (1) policy and coordination to strengthen stewardship, harmonisation and coordination; (2) priority interventions that require national scaling up across sectors to reduce stunting; (3) institutional and capacity building; (4) communication and advocacy; and (5) monitoring, evaluation and research. Implementation is starting in 14 districts with high poverty and stunting rates, and aims to achieve significant impacts by 2015, to leverage further resources and support national scale-up.

Although the MCDP is costed, government is not yet providing full financial support for its implementation; initial programme funding is being prioritised through the SUN Fund, a joint financing mechanism aimed at promoting harmonisation and alignment of financial support for nutrition among key partners, stakeholders and government with the intention of avoiding duplication of efforts, as well as reducing transaction costs for all partners (DFID *et al.* 2014). Activities under the MCDP to date are numerous,² but implementation of the MCDP on the ground across sectors is in its early stages, with some notable successes³ and challenges.⁴ It is recognised that the NFNC, being the institutional home of the MCDP, has a significant role in monitoring and oversight of the programme's delivery, and for coordinating all stakeholders including those supporting the programme outside of the SUN Fund, but NFNC capacity remains an issue.

4.2 Food fortification and supplementation

The two major food fortification strategies in Zambia are iodised salt and vitamin A fortified sugar. Salt has been iodised in Zambia since the 1970s, and currently salt is fortified at 15–40 parts per million. Historically, levels of Iodine Deficiency Disease (IDD) have been high (NFNC 1995), but more recent surveys have found positive impact of fortification, and average iodine levels are no longer a major public health concern (NFNC 2003, 2012). While the salt fortification programme has been highly successful in combating IDD, the levels of iodisation of salt observed in both impact surveys raised another concern – only 53 per cent of the population in 2011 was accessing adequately iodised salt (NFNC 2012) – short of the World Health Organization indicators for Universal Salt Iodisation of above 90 per cent of households (WHO 2007) – and measures are now under way to strengthen quality control, regional level harmonisation, advocacy and communication, and social marketing. The vitamin A programme started in 1998 with the mandatory regulation on sugar fortification also being established in the same year (Serlemitsos and Fusco 2002). At the time when sugar fortification began, it was estimated that about 50 per cent of the population was accessing the fortified sugar. However, the Living Conditions Monitoring Survey of 2006 indicated that about 60 per cent of the population was accessing fortified sugar. This may suggest that vitamin A sugar fortification programme coverage has improved and may be contributing to reductions in vitamin A deficiency seen in Zambia. Biofortification of 'orange' maize has been shown to increase vitamin A intakes among rural Zambian children compared with typically-consumed white maize (Nuss *et al.* 2012). These varieties are currently being disseminated in Zambia by Harvestplus and limited quantities are available in local supermarkets. Other biofortified food crops available in Zambia are beans with high content of iron and zinc, and orange sweet potato with high levels of pro-vitamin A. Impact of these innovations on the nutrition status of the vulnerable groups are too early to determine.

Vitamin A and iron supplementation programmes are well established in Zambia. Vitamin A supplementation is carried out twice-yearly during Child Health Weeks, involving intensified social mobilisation and service delivery over a few days, at no cost to the community. Data from programme monitoring shows coverage of vitamin A supplementation improving over recent years, reaching over 80 per cent (MOH 2012). It has been difficult to assess to what extent reductions in mortality can be attributed to this programme. Iron folate for pregnant women is provided through antenatal care; in 2007 about 43 per cent of pregnant women were supplemented (CSO *et al.* 2009), though there are issues with compliance and late start, as many women go for their first check-up after three months of pregnancy. Schoolgirls aged 12 years are supplemented with iron under the School Health and Nutrition Programme. There is no deliberate policy to address iron deficiency in young children through focused supplementation, though the provision of de-worming tablets to infants and young children aged 12–59 months of age during Child Health Weeks is established and may contribute to reduced anaemia, with around 80 per cent coverage. Piloting of micronutrient powders for children is

under way in one district with support from UNICEF and if successful, this intervention would be scaled up through the SUN Fund and other resources. Masuda and colleagues (this *IDS Special Collection*) contribute an assessment of spirulina algae as a complement to current supplement regimes, finding some positive results on height-for-age z-score from this locally produced resource.

4.3 Education, agriculture and social protection

There have also been some positive steps in sectors outside of health. The predominance of starch-based diets with little variation or nutrient-density is a key underlying factor determining the level of child malnutrition in Zambia. The Ministry of Agriculture and Livestock (MAL) supports a food-based approach to nutrition improvement, and has a set of Food and Nutrition Operational Guidelines (MACO 2008). However, in practice agriculture sector policy drives production of a national supply of maize, with very little room for the promotion of other produce, including foods that are more nutrition-dense and therefore can improve child diets (Harris and Drimie 2012). The share of agricultural budget allocations to direct input subsidy programmes to support maize production under the Farmer Input Support Programme (FISP) and the Strategic Food Reserve of the Food Reserve Agency (FRA) accounted for 73 per cent of the total approved MAL budget for the Sixth National Development Plan (SNDP) and, as a result, very little funding has been available for the MAL's core functions (Ministry of Finance 2012), let alone for promoting agricultural diversity or other nutrition-sensitive work. Recent work under the Comprehensive Africa Agriculture Development Programme (CAADP), to which Zambia is a signatory, has encouraged southern African countries to incorporate nutrition into National Agriculture Investment Plans (NAIPs), which dictate the allocation of funding within agriculture ministries. Zambia has been successful in writing some nutrition-sensitive sections into their NAIP, including the beginnings of a diversification of crops supported under the national input subsidy programme (FISP).

In education, Zambia has witnessed the convergence of two parallel school feeding programmes in creating the Home Grown Feeding Programme (HGFP). From an initial caseload of 320,000 children, the programme reached 850,000 children across 31 districts in 2011 (WFP 2013). The future HGFP aims to achieve financial sustainability through the eventual ownership and funding by the Zambian government, and should involve the cooperation of various ministries. The positive impacts of the school feeding programme are thought to act through the relationship between a child's nutritional wellbeing and health to that of increased school enrolment, attendance and overall academic performance, with a spillover effect in the agriculture sector where higher production and access to markets can have an impact on community development.

There has also been a major policy shift by the Zambian government to expand the Social Protection Programme, with efforts under way to make it more nutrition-sensitive and encourage grass-roots engagement with women in particular. In the 2014 national budget, government more than doubled the budgetary allocation to support Social Cash Transfer and Child Grant Schemes (Ministry of

Finance 2012). Seidenfeld and colleagues (this *IDS Special Collection*) investigate the impact of Zambia's expanding Social Cash Transfer Programme on child nutrition, finding that the transfers have positive impacts on key underlying factors such as food security and dietary diversity, and on height in sub-groups with access to clean water and more empowered mothers. The authors suggest that the scale of the cash transfer programmes provides an unprecedented platform on which to deliver nutrition-sensitive programming. Targeting the cash transfers to households with pregnant and lactating women would potentially yield large benefits given the importance of the first 1,000 days period. Another form of local-level cash transfer was investigated by Kawana and colleagues (this *IDS Special Collection*), assessing whether cash or food transfers improved the nutritional status of people living with HIV, and finding some improvement in Body Mass Index, Household Dietary Diversity Score, antiretroviral therapy (ART) adherence, and mean CD4 count in both treatment groups. There was no significant difference between groups, however, and no control group against which to assess these changes.

Several other articles in this *IDS Special Collection* detail experiences with programmes aimed at addressing key determinants of malnutrition in Zambia. Mulenga (this *IDS Special Collection*) describes a programme based on the Positive Deviance model for children at risk of moderate and severe underweight, citing variable outcomes in terms of catch-up growth over a year after a household completes the programme, and noting several lessons for implementation and follow-up quality that may inform future interventions. Finally, Moramarco and colleagues (this *IDS Special Collection*) describe an integrated project comprising in-patient and community-based treatment for severe malnutrition, linked to home gardening activities for households presenting with malnourished children, and capacity building for health centre staff, that might inform future programme models.

5 Risks to undernutrition reduction

This section outlines four sets of risks identified through the literature and from country experience: stakeholder coordination, capacity gaps, funding gaps and evidence gaps.

5.1 Stakeholder coordination

Chilufya and colleagues (this *IDS Special Collection*) working with Zambian civil society reflect on processes undertaken since 2011 to build political commitment in the context of the SUN movement in Zambia, and the SUN-CSO Alliance's roles in strategic advocacy, accountability and capacity building of key political actors. The authors note that while important steps have been taken to build political commitment, and the profile of nutrition has certainly been raised in Zambia, issues around funding and attention to effective intersectoral coordination remain a drag on implementation. These challenges go beyond intersectoral coordination alone but also affect *intra*sectoral coordination – vertical coordination within ministries, and among different groups working within the same sector – as well as coordination among donors, the UN system and other agencies supporting nutrition in the country. Drimie and colleagues (this *IDS Special Collection*) document one particular process whereby local-level ministries are

brought together using new structures and intensive capacity building to engage multiple sectors for nutrition, focusing at district level as a context where sectoral siloes are less rigid. The innovation the authors report is based on a process of understanding, trust-building and commitment that is slowly translating into altered systems for intersectoral nutrition action. Seco Grütz and colleagues (this *IDS Special Collection*) from the donor community echo civil society's call for further financial and human resources and coordination between sectors, and reflect on the role that the donor community has played and lessons learnt for generating commitment and action in a context where nutrition has been a largely neglected issue. They conclude that the last three years of advocacy and planning has laid a strong foundation on which to build nutrition action, but that challenges remain around shifting from a curative to a preventative approach by bringing in other sectors such as agriculture and local government to the nutrition agenda and demonstrating results.

The need for coordination is vital, because different ministries and sectors need to do things differently to support a sustained and rapid decline in undernutrition rates. Nonetheless, Zambia will reap greater benefits by defining and strengthening the implementers and delivery channels for the most effective nutrition interventions. Below we describe some issues in food production, care provision and the health environment which are likely to be holding back intersectoral undernutrition reduction efforts.

Currently, food security in Zambia is very much equated with staple food production, particularly maize, with a majority of agriculture funding going to two major schemes to grow and procure just a few staple crops, and therefore crowding out diversification into more nutrient-dense food crops or animal foods (Harris and Drimie 2012). In turn, diets in Zambia are monotonous and traditionally based on *nshima*, a thick starchy porridge made from maize or other staple crops, eaten with a small amount of 'relish' of a few basic vegetables sometimes supplemented with a little meat, beans or fish; intake of nutrient-rich foods is seasonal and amounts of these foods often minimal. Complementary foods are introduced early to Zambian children, and these are dominated by starchy staples; both feeding frequency and food diversity are generally low, and only 37 per cent of Zambian children aged 6–23 months are fed in accordance with agreed best practices (CSO *et al.* 2009).

Ways therefore need to be found to make agriculture and food systems more nutrition-sensitive, alongside promoting better diets. One way of doing this is to decrease the price of more nutritionally valuable foods. In this *IDS Special Collection*, Chibuye assesses the impacts of the 2008 food price crisis on child attained height-for-age (HAZ); findings are mixed but in general stunting is quite sensitive to a wide range of food prices, suggesting that initiatives to reduce the prices of nutritious foods will improve stunting. Two further articles highlight other ways of restructuring food production. Longley and colleagues (this *IDS Special Collection*) note that despite the nutritional and cultural importance of fish in the Zambian diet, there is currently inadequate year-round supply from wild and farmed sources to meet the nutritional needs of all Zambians, and there is a lack of understanding of the

potential contribution of different fish prepared in different ways to diets in the first 1,000 days. Ismail and colleagues (this *IDS Special Collection*) present data on the issue of aflatoxin contamination of maize and groundnuts, and evidence for an impact on stunting; the authors note that little is known about the extent of the problem – either contamination levels or their effects – in Zambia due to a lack of testing, but studies from similar contexts suggest that if the different sectors involved cannot come together to understand and address it, the health impact could be significant.

In terms of care practices, more than 95 per cent of children in Zambia are breastfed directly after birth (CSO 2012), but exclusive breastfeeding during 0–6 months accounted for 46.7 per cent in 2010 (*ibid.*), increasing the risk of diarrhoeal diseases early in life; almost a third of children aged 6–23 months had a diarrhoeal episode in the past two weeks in the most recent survey (CSO *et al.* 2009). One potential reason for poor care practices may be the status of women and mothers' empowerment to make care decisions; many of these indicators are poorer in women with less education (CSO *et al.* 2009). Sixteen per cent of women are estimated to be infected with HIV, with ART coverage in adults standing at around 90 per cent; mother-to-child transmission and overall HIV rates in children under 14 are both declining, but only 28 per cent of infected children are currently receiving treatment (National AIDS Council 2012). Vaccination coverage is low at 68 per cent of children aged 12–23 months; 6 per cent of children do not receive any vaccinations (CSO *et al.* 2009), and levels of infection such as malaria and respiratory illness are high, impairing nutrient utilisation and impacting nutrition (NFNC 2013).

On the health environment, the health system itself is weakened by inadequate financial and human resources (MOH 2009), and provision of basic services such as water and sanitation is poor, particularly in rural Zambia where 50 per cent of households have access to safe drinking water; in urban areas this figure stands at 84 per cent (CSO 2012).

Overall, then, there is a difficult environment for improving nutrition with so many key areas that need to be addressed simultaneously by coherent and joined-up policy and programming.

5.2 Capacity gaps

The capacity of the nutrition-related workforce and resourcing of nutrition-related programmes has been recognised by government, donors and the nutrition community in Zambia to be an important impediment to progress (THET 2012). For example, within the Ministry of Health (MOH) there are positions for nutritionists at each level; however, not all of these positions are filled. The National Health Strategic Plan in 2005 noted that 65 out of a recommended 200 nutritionist positions at all levels were currently in post (MOH 2005), and this has not improved; a 2009 government analysis showed that 68 out of 72 districts operate at less than 50 per cent of staffing levels required to meet the basic health needs of that district's population (MOH 2009), and a more recent plan again calls for higher levels (MOH 2011).

The newly established cadre of Community Health Assistants (CHAs), front-line health workers who are trained for a year in a range of maternal and child health issues, including nutrition, is a promising development. However, a current recruitment freeze and the time needed to train a critical mass of CHAs, means that Zambia will also need to rely on other cadres of front-line workers to deliver nutrition counselling. As shown by countries like Ethiopia with its health extension workers, and Bangladesh with its network of community health workers and volunteers, this will require significant efforts and resources to train, supervise and incentivise front-line workers in order to ensure quality nutrition services (Baker *et al.* 2013). In Zambia, results-based incentives for front-line workers and national workers to support district counterparts are being explored as part of new health and nutrition programmes.

Most higher-level nutrition training in Zambia has been at diploma level and biased towards food science and technology, and many nutritionists have been found to be more comfortable with food production, processing and preservation than with the range of underlying and basic-level causes of malnutrition. In response to this gap, a new BSc nutrition degree has been introduced at the University of Zambia (UNZA) and is being funded initially by the UK Department for International Development (DFID); more than 40 students are currently enrolled, with plans to increase intake of new students annually. The aim is to create a new cadre of more highly qualified nutritionists who could fill much needed gaps at implementation, policy and planning levels. The SUN Fund has agreed to provide further support to help consolidate the BSc and establish an MSc for future teaching sustainability. In addition, a nutrition workforce planning exercise is under way to help determine how many nutritionists and dietitians Zambia should have at different levels of the system, and how it can gradually fill the current gaps in line with SUN commitments; this should include filling gaps in ministries other than health.

5.3 Financial gaps

Weak financial tracking and resource mobilisation for nutrition from various government, donor and non-governmental organisation (NGO) sources continue to be an impediment in determining and securing finances needed to support nutrition at country level. Challenges that require attention include increasing domestic financing to leverage external support from donors; improving information on nutrition financing to inform policymakers on how resources should be allocated and ensure that investments in nutrition are consistent with the country's accelerated development agenda; and better tracking procedures for resources in relevant line ministries at national and sub-national levels to ensure transparency and accountability in the delivery of programmes for nutrition. To date, there has been no single comprehensive mechanism that would help to provide and track financial flows through nutrition interventions in the country. This gap has been recognised and some donors in Zambia have agreed to pool such support through the SUN Fund in addressing undernutrition. In addition, the global SUN is working on a methodology for countries to track nutrition-specific and nutrition-sensitive spend.

Currently, public funding for government programmes is prioritised through sector-specific Medium Term Expenditure Frameworks (Ministry of Finance 2014). The overall budget for nutrition-specific interventions has increased significantly as a result of a recent increase in the health budget with re-organisation of health services under the ministries of health and community development. The current allocation to the health sector from the government in 2014 is ZMW4.5 billion (approx. £450 million), which is a 29 per cent increase (about ZMW1 billion) from 2013. The specific budget allocation for nutrition (Infant and Young Child Feeding (IYCF) and Integrated Management of Childhood Illness (IMAM)) for 2014 is ZMW355,455, which is inadequate to implement the MCDP programme.

The budgetary allocation to the NFNC has been increased 35 per cent (*ibid.*), mainly as a result of the rationalisation and harmonisation for the terms and conditions of service for grant-aided institutions under the MOH. It is more difficult to assess nutrition-sensitive budgets, as budget lines are not allocated specifically to nutrition. As an example though, the budgetary allocation in 2014 to the Social Cash Transfer (SCT) increased by 140 per cent as compared to the 2013 budget (Platform for Social Protection Zambia 2014). This is an encouraging investment by government to expand the coverage and distribution of this protection to poorer groups, who are also those most vulnerable to poor nutrition. It is yet to be seen how the benefits of the SCT will be translated at ground level and to impact in reduction of undernutrition in these populations.

5.4 Evidence gaps

The articles from this *IDS Special Collection* and from elsewhere suggest some gaps in our understanding that are constraining action. First, it would be useful to derive some Zambia-specific estimates of the economic benefit of investing in nutrition. This is important because it is clear that Zambia lies within a policymaking environment where economic growth is the central metric of government attention. For example, in the African Development Bank (AfDB) latest report (AfDB Group *et al.* 2013), the section on Zambia does not mention nutrition once. Hoddinott *et al.* (2013) estimate such returns for eight sub-Saharan African countries, but not Zambia, and conclude that the median benefit cost ratios of such investments are approximately 1:15. These kinds of estimates can help make the case for nutrition on economic grounds, supporting the case made on a health and rights basis. These investments also help improve the quality of economic growth, ensuring that it is sustained and translates into human wellbeing outcomes. Investments in nutrition improve child growth and development as well as economic growth and development, sustaining the child throughout a productive adulthood and sustaining the economy beyond the minerals boom by investing in human capital. The AfDB Group *et al.* (2013) conclude that Zambia is vulnerable on both these counts: 'Zambia's long-term economic prospects hinge on the prudent capture and deployment of copper revenues as well as harnessing the potential of non-copper minerals and other natural resources. Ultimately, manufacturing activity, driven by the private sector, and directly or indirectly linked to these natural resources, will be critical

to the country's long-term prosperity.' What better way to capture and deploy copper revenues than to invest a significant portion of them in the first 1,000 days after conception, to provide a platform for future growth and development? Investing in nutrition will help transform a temporary natural resource boom into a sustained human resource boom. The resources are there: the World Bank estimates that Zambian tax revenues are 17 per cent of its GDP, or US\$3.5 billion per year. Compare that to the few million dollars per year spent on nutrition-specific interventions. The World Bank is currently engaged with costing the Zambian NFNSP, including a benefit analysis in terms of Disability-Adjusted Life Years and lives saved, which will go some way towards filling this gap.

Second, it is clear that inequality is a major issue in Zambia; the country has one of the highest income inequality measures in the world (World Bank 2014a). Despite this, the wealthiest groups in Zambia are unable to escape stunting; UNICEF (2013) reports that the 2007 Zambian DHS shows that the population with the top 20 per cent of income still experiences stunting rates of 33 per cent. Higher income provides little refuge from malnutrition in Zambia. This likely reflects the fact that improvements in health services, water, sanitation and other nutrition-relevant factors are not easily purchased as infrastructure does not exist. Greater quality of services and greater equity of access are vital if stunting is to be reduced. Therefore research that delves into the extent of inequity in access to good nutrition services, the drivers of access, and what to do to improve it would be of high value.

Third, where are the nutrition capacity gaps the most constraining? Is it the lack of front-line workers delivering nutrition-specific interventions? Or is it that these workers are not trained and equipped to do the right things? Or is it a lack of incentives of front-line workers delivering nutrition-sensitive interventions to embed nutrition within their domains? Or is it the inability of different sectors and ministries to plan and act in concert – a lack of strategic and managerial capacity? Or is it all of the above? Some more research on these issues is sorely needed.

Fourth, much evidence is needed to improve the effectiveness of nutrition-specific interventions. A consultative workshop led by the SUN Fund and NFNC in October 2013 identified a number of gaps around (a) strengthening growth monitoring and promotion at health facilities and community level facility points; (b) identifying key inhibitors and facilitators for the adoption of appropriate nutrition behaviours and practices; and (c) ways of promoting diet diversity either through household practices around food processing, preservation and storage, strategies to influence the consumption of diverse diets by pregnant and lactating women and the promotion of scale-up and uptake of pro-vitamin A biofortified foods. Understanding how to expand the management of acute malnutrition is another area Zambia needs to put much more effort into as current coverage of acute malnourished children is inadequate, at an estimated 17 per cent (WFP 2013).

Finally, there is also a set of research issues around how to make nutrition-sensitive interventions have a bigger

impact on nutrition. For example, how to manage the levels of aflatoxin in the production, processing and storage of cereal and grain (as a prerequisite for developing Zambian ready-to-use therapeutic foods (RUTF), as well as for general consumption); the influence of school-based nutrition education on nutrition behaviour and practices at household level; measures for integrating nutrition in agricultural policy and implementation; how to strengthen the power of women to influence decision-making around nutrition-relevant action; and how to maximise the nutrition impact of social protection programmes (for example, when cash and when food? Age-based targeting or not? Focused on prevention or treatment?). These evidence gaps are crying out for more – and more rigorous – impact evaluations.

6 Conclusions

Zambian malnutrition rates have been high for a very long time, remaining stubbornly high despite high GDP growth for long periods in Zambia's history. Unfortunately, these figures have not been tested by an upsurge in resource allocations to nutrition-relevant actions; spending on nutrition programmes has remained negligible in relation to tax revenues. It is to the great credit of the Zambian leadership that a great deal of momentum for nutrition has been built since 2011; this must now be acted upon.

The challenge now is to turn that momentum into increased and more equitable programme coverage, improved quality of service delivery, and a wider set of sectoral instruments that support nutrition in a sensitive way. Undernutrition reduction requires action on a number of fronts. While a whole of government effort is necessary, it is not sufficient; undernutrition reduction requires a whole of society effort: civil society, researchers, the private sector, the media and international development partners all need to pull together. Civil society has to keep the pressure on government, the private sector, development partners, the media – and itself – to make more undernutrition-reducing choices and increase demand for better nutrition, even while keeping more than an eye on burgeoning rates of over-nutrition. Researchers need to step up their efforts to guide resources to where they have the greatest and longest lasting effects. The articles in this *IDS Special Collection* have shown how the commitment to nutrition has been built in Zambia, and have provided some pointers and guides to the ways in which that increased commitment could be leveraged to raise resources and how to allocate these. We have identified a number of gaps that can be filled by a committed whole of society approach: gaps in stakeholder coordination; capacity, funding and evidence.

Zambia is potentially on the cusp of a great economic transformation. Can gains in economic growth from temporary mineral resources be translated into gains in child growth which reduce mortality and suffering, but also serve to power economic growth in a sustainable way? Or will we see a situation where current fast economic growth is another redundant flash in the pan? By investing much more of their increasing stream of tax revenues in malnutrition-reducing efforts, Zambian policymakers can make the transformation vision much more likely. In this way, economic growth can be made more sustainable and

more transformative. Investing in the most vulnerable members of its society – children under the age of two and their mothers – is a sure-fire way for Zambia to turn fast

Notes

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- 1 Ministries of agriculture, health, education, local government (water and sanitation), and community development and maternal and child health (social protection).
- 2 Main highlights of the MCDP include: (1) developing guidelines for a set of 14 nutrition priority interventions to be included in the ‘minimum package’ to be scaled up at country level with support of the SUN Fund; (2) development of guidelines for the preparation of

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- multisectoral district plans to be supported under the SUN Fund; (3) identification of priority operational research themes; (4) development of the national level sector plans for the relevant line ministries (agriculture, health, local government and the NFNC), including two multisectoral district plans; and (4) support for ten scholarships to Ministry of Health students enrolled at the national university to pursue the BSc in human nutrition and dietetics.
- 3 The programme is tentatively bringing together different actors – donor community, government departments at national, provincial and district administrations, traditional rulers and civil society organisations (CSOs); development of multisectoral plans at the district level has given impetus for the establishment of district-level nutrition coordination committees to create demand for and coordinate nutrition services.
 - 4 The SUN Fund was established outside the national coordinating authority due to capacity issues at the NFNC, through international competitive tender.

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The Impact of Rising Food Prices on Child Nutrition in Zambia

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Abstract This article uses micro-econometrics to assess the impact of a price increase in various food commodities on the height-for-age z-scores of under-five children in Zambia. Using data from the Living Conditions Monitoring Survey (LCMS), the article finds that while the rise in prices of some food commodities has a negative effect on children's health outcomes, others have a positive effect. Specifically, the estimated results show that child height-for-age z-scores are negatively affected by an increase in cereal prices and other commodities such as chicken, beans and eggs, which are rich in proteins and energy. The article suggests that the positive health outcomes associated with the rise in prices of commodities such as beef in urban areas may be as a result of substitution to other products such as chicken, which has comparatively higher values for some nutrients.

1 Introduction

What is the effect of rising food prices on nutrition outcomes of children below the age of five? This question is asked in the wake of the global food price crisis in 2007–08, which saw Zambian food prices soar by about 60 per cent.¹ The price of less refined maize flour (locally referred to as roller meal) increased by 40.6 per cent. This experience is not unique to Zambia as other African countries also experienced soaring prices. For example, Wodon and Zaman (2009) reported that during the first quarter of 2008 alone, there was a 20 per cent increase in rice prices in Burkina Faso and a 41 per cent increase in maize prices in Kenya.

The question posed in this article is even more important as the levels of child stunting in Zambia before the 2007–08 food crisis were very high. The 2007 Zambia Demographic and Health Survey (ZDHS) found that 45 per cent of Zambian children were stunted or short for their age (GRZ 2009: 156). Stunting is a manifestation of long-run inadequate intake of nutrient-dense foods such as animal-source foods (meat, poultry, eggs, fish, milk), fruits and vegetables. Animal-source foods are recognised as having high energy density and as being good sources of high-quality protein, iron and zinc, among others (FAO 2013). All these nutrients enhance children's physical and cognitive development.

Considering poorer households spend over half of their incomes on food (Deaton 1989; Skoufias, Tiwari and Zaman 2012), a major concern arising from high prices of food commodities is that households may be induced to substitute away from foods that are high in required nutrients. Brinkman *et al.* (2010: 158) postulate that the decreased purchase of more expensive foods typically equates to consumption of fewer nutrient-dense foods. Other researchers such as Torlesse, Kiess and Bloem (2003) found that households spend more on non-rice foods when rice prices decrease while Campbell *et al.* (2010: 192) found that households with higher expenditure on rice in Bangladesh have an increased

incidence of child stunting in comparison with households with higher non-rice expenditure.

There is a significant amount of literature on the importance of nutrition in early childhood. For example, using longitudinal data from rural Zimbabwe, Alderman *et al.* (2006) showed that improved pre-schooler nutritional status, as measured by height-for-age, is associated with increased height as a young adult, higher level of grades attained and an earlier age at which the child starts school. Behrman and Hoddinott (2005: 548) and Brinkman *et al.* (2010: 153) argue that physical growth lost in early years as a consequence of malnutrition is, at best, only partially regained during childhood and adolescence, particularly when children remain in poor environments. Similarly, the FAO (2013) suggests that stunting causes permanent impairment to cognitive and physical development that can lower educational attainment and reduce adult income.

On the other hand, the potential for catching up during adolescence for previously stunted children has been studied by some researchers. For example, using longitudinal data from Tanzania, Hirvonen (2014) found considerable catch-up growth for individuals who were stunted in childhood. Despite these findings, questions remain on the lasting effect of deficits in cognitive development among children. Grantham-McGregor *et al.* (2007) argue that early childhood undernutrition is associated with long-term deficiencies in cognition and educational outcomes.

Meanwhile, Thomas and Strauss (1992) have investigated the effect of prices on child heights in Brazil. Focusing on food groups which are likely to have an impact on the health of children, they found among others that higher prices for dairy products and sugar are associated with shorter children and that this effect is greater for urban children. They also found that a rise in the price of cereals has positive effects on rural children. In urban areas, a rise in the price of beans was associated with taller children at the bottom of the expenditure distribution. Similarly, a

study by Christiaensen and Alderman (2004) in Ethiopia found that higher teff (Ethiopia's main staple) prices are associated with shorter children while higher maize, sorghum, beef and milk prices are associated with taller children. Ensuing from these studies is that the effects of rising prices on nutrition outcomes of children are dependent on the commodity and other factors such as the area of residence and age.

One starting point for assessing the individual price effects of a commodity is through household food budget shares. Appendix 1 shows the evolution of household food budget shares in Zambia between 2006 and 2010, disaggregated by region. The table shows that there is a displacement of some items in 2010. In urban areas, of the items that claimed 4 per cent or more of the food budget share, the much preferred and refined maize flour (locally known as breakfast mealie meal) was displaced by the less refined and cheaper roller meal. In rural areas, maize grain retained the highest share and households increased the budget share of vegetables from only 3 per cent in 2006 to 13 per cent in 2010. Reductions are observed in budget shares for protein products in both regions. For example, in rural areas, the share of the budget spent on fish reduced from 8 per cent to 4 per cent, while in urban areas the budget share for beef and fish reduced from 6 per cent to 4 per cent each.

Using cross-sectional data from the 2006 and 2010 Living Conditions Monitoring Surveys (LCMSs) and district price data from the government's monthly retail price survey, this article compares the nutritional outcomes of children under five years old before and after the 2007–08 price rise in Zambia. It does this by pooling the two rounds of cross-sectional data. With the inclusion of district fixed effects and province-by-year interaction terms (further explained in the empirical strategy section), the idea is to compare two cohorts of children originating from the same district at two points in time (2006 and 2010). These cohorts are exposed to very different prices as 2006 was before the 2007/08 price crisis and 2010 after.

The article contributes to the literature in four ways: (i) unlike previous studies, this study analyses the effect of 17 different food commodities on child nutrition outcomes. Previous studies analysed a limited number of food products or food groups; (ii) as the impact of rising food prices is likely to vary across age groups, the article categorises age into three groups: six months and below; between six months and two years and between two and five years; (iii) the author utilises data sets that coincide with the period of the crisis; and (iv) to the best of the author's knowledge, this is the first article on Zambia that focuses on the direct link between the change in prices of particular food commodities and their effect on child health outcomes. A number of articles on the effect of food prices on households have been written on Zambia but none of them focus on this stunting link. See for example, a simulation of the impact of food prices on poverty (Ivanic, Martin and Zaman 2012), the impact of the food, fuel and financial crisis on Zambian households (McCulloch and Grover 2010) and Hossain, King and Kelbert (2013) who use mainly qualitative approaches to understand the effects of the food price crisis on everyday

lives of selected households in a number of countries, including Zambia.

The following hypotheses are posed in this article: first, a rise in food prices is important for determining height-for-age z-scores (HAZ). Second, the level of importance varies across regions (rural/urban), gender and age groups.

Given the budget shares (see Appendix 1) and price observations (see second part of Table 3), the expectation is that a rise in the price of vegetables, *kapenta*,² beans and cooking oil would have the biggest impact on stunting in the country. In addition, as maize is a staple crop, maize products are expected to have an effect on stunting levels in both rural and urban areas. It is important, however, to note that the direction of the effect is unclear as it would depend on the availability of substitute products, as well as the net production position of a household. The net food selling households would theoretically benefit from higher food prices while net food buyers would suffer a welfare loss, which would subsequently affect children's health outcomes.

Using the Net Benefit Ratio (NBR) analysis³ developed by Deaton (1989), the author finds that about 76 per cent of urban households are net buyers of cereal products⁴ in comparison to only 32 per cent in rural areas. Therefore, these households are likely to lose from a rise in cereal prices. An NBR estimation of individual crops and also of all food commodities still shows that a higher proportion of urban households are likely to suffer a welfare loss in comparison to rural households.

In the analysis, height-for-age is converted into the standardised z-scores using US data as an international reference standard (see Kuczmarski *et al.* 2000). The z-scores are derived after subtracting the age- and gender-specific means from the reference data and after dividing by the corresponding standard deviation (Haddad *et al.* 2003). The growth of children with a z-score of minus two standard deviations (-2 SD) is considered unhealthy growth (GRZ 2009: 155).

The choice of using child height, conditional on age and gender, instead of low weight-for-age z-scores as a measure of child nutrition outcomes has been made in this article as it is a good predictor of long-run cognitive and other human capital deficits when children are below -2 SD in the first two years of life (Barrera 1990; Thomas, Strauss and Henriques 1990; GRZ 2009).

2 Empirical strategy

As the nutrition status of children is not only influenced by inadequate long-term dietary intake, the econometric strategy applied in this article employs district-level fixed effects while controlling for idiosyncratic (e.g. age and gender) and covariate factors such as household and community characteristics. As suggested by Christiaensen and Alderman (2004), household access to (and distribution of) food, availability and utilisation of health services and care provided to children influence children's nutrition status.

Since growth faltering varies with age (e.g. see Shrimpton *et al.* 2001), the article categorises age into three groups:

six months and below; between six months and two years and between two and five years. This will facilitate a more precise analysis on food price effects on HAZ for children with the first two categories corresponding to the crucial 1,000 days from conception to a child's second birthday. This categorisation also fits into the notion that child health outcomes generally exhibit a U-shaped pattern of deterioration and subsequent improvement where children face a decline from six months of age through the second year of life, followed by a slight improvement thereafter (Barrera 1990: 70).

In the reduced form specification formulae, the height-for-age z-score (*HAZ*) for child *i* from district *d* at time *t* is further modelled as a function of household characteristics (*H'*) that affect child height. These variables include the mother's characteristics (e.g. education and age) and binary variables on the following: ownership of a flush toilet and a radio and access to tap water. All these characteristics are meant to enhance a child's nutrition and health outcome. The rationale is that children of better educated mothers are healthier, while access to media information could enhance child nutrition, and access to clean water and sewerage significantly affect child height. Community level characteristics (*E'*) include variables such as logged distance to a health centre. The model also incorporates a vector of 41 district-level⁵ food prices *P'* of primary food commodities consumed by the household for the corresponding months when the LCMS was conducted, that is December 2006 and December 2010. The estimated model is formulated as:

$$(1) HAZ_{idt} = X_{idt}\beta_1 + H'_{idt}\beta_2 + E'_{idt}\beta_3 + P'_{dt}\beta_4 + \delta_d + (\theta_p * r_t) + \epsilon_{idt}$$

where ϵ_{idt} represents the error term.

Modelling the impact of price changes is difficult due to various endogeneity concerns related to omitted variables that are not controlled for. For example, prices are likely to be correlated with time-invariant characteristics, such as local governance efficacy and geography. To address these concerns, the author includes district-level fixed effects (δ_d) capturing all observed and unobserved time-invariant characteristics of the districts. But, unobserved time-varying factors may lead to similar omitted variable bias resulting in a biased estimate of β_4 . For example, it is plausible that positive macro-economic shocks (e.g. new discovery of mineral resources) increase economic activity in the area leading to higher prices. β_4 would not only capture the effect of the price change but also the effect of the improvement in the general macro-economic situation. In an attempt to alleviate these concerns, the author adds province-by-year interaction terms ($\theta_p * r_t$) to the model.⁶ These interaction terms capture all observed and unobserved changes between the two years at the province level. Now, in the presence of district fixed effects and province-by-year interaction terms, the impact of the price changes on child health is identified from district specific changes in prices after controlling for macro-shocks common to all districts in a given province. This strategy yields an unbiased estimate of β_4 if the unobserved time-variant characteristics that influence both district level prices and child health do not vary across districts within a province. While these strategies

remove a large amount of the potential bias in the price estimates, some correlation between P'_{dt} and ϵ_{idt} may remain. The price estimates that follow should therefore be interpreted with some caution.

3 Data

The data analysed here are taken from two sources: the 2006 and 2010 Living Conditions Monitoring Survey (LCMS), a nationwide household survey, and the district retail price data collected on a monthly basis. Both of these surveys are conducted by the government's Central Statistical Office (CSO) in Zambia.

The two LCMSs are used to signify the pre-food crisis period and the period after the initial food crisis. Food prices in Zambia continued to rise and exhibited a volatile characteristic post the 2007/08 global food crisis period. Hence, the expectation is that households would have adapted to high prices by 2010 and the effects on child health outcomes would be observable by then, more so for the under twos.

District-level food prices are only available for 41 out of the 73 districts. In the absence of food price data at a household or community level, the procedure followed here is that suggested by Deaton (1997: 283) of merging regional price data with the household survey data. As such, each household has been associated with the prices for the district it is located in using the actual month the survey was conducted. In this article, 17 food commodities representing various nutrition groups are used.

Therefore, only the children from the districts with information on prices and also without missing information on relevant variables such as height and age are included. As such, a sub-sample of 11,338 children under five is used in this analysis. Of the total, 6,167 reside in urban areas while 5,171 reside in rural areas.

Furthermore, to simplify the interpretation of the results, the estimated units are converted to centimetres using data from the National Centre for Health Statistics/Centres for Disease Control and Prevention (NCHS/CDC).

4 Results and discussion

Contingent on the rise in commodity prices, this article assesses the health outcomes of children below five years old. Table 1 provides descriptive statistics for the variables used in the analysis. There is an equal representation of boys and girls. The highest level of education attained by the mother is relatively higher in urban areas (on average, mothers completed lower secondary education) than rural areas (mothers completed primary education on average). In relation to other household characteristics and as expected, a considerably higher proportion of households in urban areas have a flush toilet and they use a tap as the main source of their drinking water in comparison to rural areas. The table also provides information on food prices. In nominal terms, higher price changes are observed in cereals and proteins. The highest price increase was observed in rice (102.7 per cent) and *kapenta* (102.1 per cent). This could be an explanation for the reduction in shares between the two years in both regions (see Appendix 1), particularly for *kapenta*.

Table 1 Means and standard deviations of determinants of height-for-age z-scores

	National		Rural		Urban	
	Mean	SD	Mean	SD	Mean	SD
Child characteristics						
Height-for-age z-scores	-1.41	1.93	-1.54	1.90	-1.31	1.94
Sex (1=male)	0.50	0.50	0.49	0.50	0.50	0.50
Child age (months)	28	15.4	27.2	15.2	28.6	15.5
Household and community characteristics						
Household size	6.7	2.98	6.9	3.3	6.6	2.7
Mother's education (years)	8.5	3.5	7.0	3.1	9.8	3.2
Log of household expenditure on food	10.6	0.86	10.2	0.84	10.9	0.77
Main source of drinking water is tap (1=yes)	0.24	0.43	0.06	0.23	0.40	0.49
Household uses flush toilet	0.20	0.40	0.02	0.14	0.34	0.47
Household owns radio	0.59	0.49	0.53	0.50	0.63	0.48
Mother's age (years)	28.2	6.2	28.3	6.4	28.1	6.0
District prices						
	2006		2010		Price increase (%)	
	Mean	SD	Mean	SD		
Breakfast mealie meal	3712	4.52	54.30	4.99	46.3	
Roller meal	2757	4.94	38.76	4.14	40.6	
Kapenta	29.56	7.35	59.74	18.64	102.1	
Fish	11.77	3.35	15.53	4.29	31.9	
Milk	2.47	1.07	3.78	0.76	53.2	
Eggs	5.61	0.56	8.64	0.86	53.9	
Rice	3.75	0.53	7.60	1.37	102.7	
Bread	2.86	0.52	4.31	0.61	50.8	
Groundnuts	5.53	2.62	7.41	2.95	33.9	
Cooking oil	17.66	1.71	28.73	1.57	62.7	
Onions	4.05	1.77	5.57	2.93	37.5	
Tomatoes	2.26	0.85	3.66	1.20	61.8	
Vegetables	1.68	0.62	2.77	1.28	64.7	
Chicken	12.85	2.49	17.75	3.61	38.2	
Beef	13.99	5.43	20.81	4.51	48.7	
Beans	5.75	2.68	9.45	4.19	64.6	
Sugar	8.59	0.49	12.64	0.60	47.2	

Source Author's calculations based on Living Conditions Monitoring Survey (LCMS) (2006 and 2010) raw data and Central Statistical Office district price data.

Table 2 provides the results based on Equation (1). The two columns present the results for rural areas and for the urban sample. First the article finds that, *ceteris paribus* and on average, male children are relatively worse off than their female counterparts. The coefficients on the age dummies confirm the declining trend in HAZ scores in these years as found in Shrimpton *et al.* (2001).

4.1 Household and community characteristics by region

The logarithm of food expenditure is used here to control for resource availability for food purchases at the household level and to provide a proxy for general welfare level of the household. Other things being equal and as

expected, Table 2 shows that an increase in food expenditure improves child HAZ scores, on average, in urban areas. More specifically, a 10 per cent increase in expenditure increases the z-scores, on average and *ceteris paribus*, by 0.022 units in urban areas. The effect is not statistically different from zero in rural areas.

Many authors have found that maternal education positively affects child health outcomes as children of more educated mothers tend to be taller (Barrera 1990: 87) and healthier (Smith and Haddad 2001). The article finds that the better educated the mother is in urban areas, the taller the children are. However, the effect in rural areas is not

Table 2 Impact of food prices on children's nutrition in Zambia (dependent variable HAZ)

	(1) Rural	(2) Urban
Child characteristics		
Male child	-0.224*** (0.041)	-0.161*** (0.040)
≤ 6 months	1.033*** (0.109)	0.947*** (0.093)
>2–5 years	-0.522*** (0.065)	-0.578*** (0.101)
Household and community characteristics		
Log food expenditure per capita	0.059 (0.037)	0.218*** (0.041)
Household size	0.016 (0.011)	0.024 (0.015)
Mother's age	0.009** (0.004)	0.006 (0.004)
Mother's education (years)	0.007 (0.010)	0.016* (0.009)
Flush toilet	0.108 (0.192)	-0.051 (0.083)
Distance to health facility (logs)	-0.025 (0.038)	0.118** (0.055)
Tap water	0.021 (0.132)	0.043 (0.070)
Radio ownership	0.104* (0.061)	0.067 (0.048)
Food prices (in logs)		
Breakfast mealie meal	-3.591** (1.543)	-2.348* (1.327)
Roller meal	-0.705* (0.417)	-1.744*** (0.587)
Rice	-0.030 (0.339)	-0.096 (0.340)
Bread	0.435 (0.791)	-1.969*** (0.553)
Beef	0.746 (0.661)	1.820*** (0.517)
Chicken	-1.973** (0.884)	-1.706* (0.939)
Kapenta	0.356* (0.193)	0.018 (0.327)
Fish (bream)	0.612*** (0.172)	0.419** (0.192)
Beans	-1.033*** (0.279)	-0.402 (0.337)
Eggs	-1.562*** (0.575)	-1.378** (0.541)
Milk (fresh)	0.103 (0.363)	1.255* (0.719)
Cooking oil	1.415 (1.090)	1.615** (0.659)
Groundnuts	0.639*** (0.218)	0.533** (0.224)
Vegetables	-0.198 (0.216)	-0.294 (0.242)
Tomatoes	0.944*** (0.235)	0.929*** (0.144)
Onions	-0.577*** (0.115)	-0.481*** (0.123)
Sugar	3.545* (1.964)	4.266*** (1.172)
District fixed effects	Yes	Yes
Province-by-year terms	Yes	Yes
Number of observations	5,171	6,167
R-squared	0.076	0.074
Adjusted R-squared	0.069	0.068

Note Robust standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Source Author's calculations based on LCMS (2006 and 2010) raw data and Central Statistical Office district price data.

Table 3 Impact of food prices on children's nutrition in Zambia – gender effects (dependent variable HAZ)

	(1) Rural boys	(2) Rural girls	(3) Urban boys	(4) Urban girls
Child characteristics				
≤ 6 months	1.382*** (0.158)	0.741*** (0.192)	1.143*** (0.147)	0.749*** (0.132)
>2–5 years	-0.488*** (0.084)	-0.537*** (0.080)	-0.600*** (0.120)	-0.537*** (0.110)
Household and community characteristics				
Log food expenditure per capita	0.094* (0.051)	0.037 (0.051)	0.280*** (0.048)	0.173*** (0.051)
Household size	0.025 (0.016)	0.007 (0.011)	0.007 (0.013)	0.044** (0.022)
Mother's age	0.018*** (0.007)	-0.001 (0.006)	0.015*** (0.006)	-0.003 (0.005)
Mother's education (years)	0.007 (0.014)	0.004 (0.014)	-0.002 (0.010)	0.031*** (0.012)
Flush toilet	0.208 (0.329)	0.024 (0.230)	-0.040 (0.121)	-0.046 (0.096)
Distance to health facility (logs)	0.060 (0.044)	-0.107** (0.048)	0.159** (0.069)	0.078 (0.055)
Tap water	-0.008 (0.153)	0.064 (0.191)	-0.004 (0.099)	0.081 (0.103)
Radio ownership	-0.022 (0.084)	0.216*** (0.070)	0.107 (0.073)	0.003 (0.063)
Food prices (in logs)				
Breakfast mealie meal	-2.925 (2.059)	-3.842** (1.670)	-1.471 (1.767)	-2.897* (1.574)
Roller meal	0.910 (0.576)	-1.911*** (0.584)	-1.450* (0.799)	-2.253*** (0.617)
Rice	-0.692 (0.533)	0.605 (0.495)	-0.253 (0.463)	-0.008 (0.281)
Bread	-0.846 (1.149)	1.075 (0.818)	-2.436*** (0.753)	-1.657*** (0.503)
Beef	0.661 (0.827)	0.724 (0.871)	1.097 (0.675)	2.579*** (0.460)
Chicken	-0.156 (0.947)	-3.614*** (1.381)	-1.744 (1.258)	-1.758*** (0.605)
Kapenta	0.165 (0.279)	0.482* (0.248)	-0.419 (0.422)	0.616** (0.281)
Fish (bream)	0.119 (0.220)	0.977*** (0.263)	0.251 (0.275)	0.756*** (0.203)
Beans	-0.783** (0.317)	-1.237*** (0.374)	-0.172 (0.427)	-0.536** (0.268)
Eggs	-1.171 (0.804)	-1.436* (0.738)	-2.370*** (0.744)	-0.535 (0.582)
Milk (fresh)	0.006 (0.377)	0.240 (0.538)	1.436 (1.121)	0.733 (0.684)
Cooking oil	2.200 (1.665)	1.040 (1.073)	2.104* (1.126)	0.802 (0.732)
Groundnuts	0.537** (0.239)	0.724** (0.358)	0.035 (0.279)	0.872*** (0.195)
Vegetables	-0.114 (0.265)	-0.399 (0.277)	-0.197 (0.290)	-0.262 (0.205)
Tomatoes	0.892*** (0.244)	1.043*** (0.310)	0.928*** (0.240)	0.889*** (0.132)
Onions	-0.600*** (0.139)	-0.549*** (0.181)	-0.422*** (0.132)	-0.577*** (0.152)
Sugar	0.287 (2.494)	7.289*** (2.283)	2.921* (1.647)	5.509*** (0.848)
District fixed effects	Yes	Yes	Yes	Yes
Province-by-year terms	Yes	Yes	Yes	Yes
Number of observations	2,539	2,632	3,082	3,085
R-squared	0.092	0.072	0.090	0.067
Adjusted R-squared	0.078	0.059	0.079	0.056

Note Robust standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Source Author's calculations based on LCMS (2006 and 2010) raw data and Central Statistical Office district price data.

Table 4 Impact of food prices on children's nutrition in urban Zambia: age effects (dependent variable HAZ)

	(1) Rural (≤ 6)	(2) Rural (>6m ≤2y)	(3) Rural (>2- 5y)	(4) Urban (≤ 6)	(5) Urban (> 6m ≤2y)	(6) Urban (>2-5y)
Child characteristics						
Male child	0.163 (0.284)	-0.345*** (0.074)	-0.229*** (0.056)	0.176 (0.189)	-0.180** (0.085)	-0.208*** (0.052)
Household and community characteristics						
Log food expenditure per capita	0.188 (0.157)	-0.054 (0.057)	0.116** (0.051)	0.434** (0.187)	0.223*** (0.068)	0.181*** (0.042)
Household size	0.060 (0.037)	0.024 (0.018)	0.000 (0.015)	-0.024 (0.032)	0.041 (0.026)	0.014 (0.014)
Mother's age	0.022 (0.020)	-0.001 (0.008)	0.016*** (0.005)	0.011 (0.021)	-0.014** (0.007)	0.015*** (0.004)
Mother's education (years)	-0.060 (0.052)	0.019 (0.012)	0.014 (0.017)	-0.075** (0.038)	0.009 (0.014)	0.036*** (0.011)
Flush toilet	3.084*** (0.552)	-0.043 (0.286)	0.298 (0.228)	-0.035 (0.338)	-0.259*** (0.093)	0.021 (0.112)
Distance to health facility (logs)	-0.047 (0.169)	-0.088 (0.053)	0.041 (0.044)	-0.328 (0.206)	0.325*** (0.067)	0.022 (0.074)
Tap water	-0.769 (0.468)	0.232 (0.221)	-0.042 (0.140)	-0.236 (0.382)	0.049 (0.065)	0.039 (0.100)
Radio ownership	-0.168 (0.277)	0.038 (0.109)	0.172*** (0.065)	0.075 (0.201)	-0.101 (0.074)	0.165** (0.071)
Food prices (in logs)						
Breakfast mealie meal	-1.849 (3.613)	-3.752** (1.732)	-4.280** (2.066)	2.111 (1.253)	-3.945 (2.616)	-1.638 (1.793)
Roller meal	1.280 (1.496)	0.888 (0.609)	-2.216*** (0.740)	-5.722 (4.182)	-1.185 (0.930)	-1.416 (0.864)
Rice	-1.627* (0.928)	-0.699 (0.540)	-0.100 (0.702)	-3.489* (2.085)	-0.106 (0.547)	0.158 (0.484)
Bread	-7.238*** (1.545)	-1.124 (1.115)	2.396** (0.970)	3.296 (3.124)	-1.751* (1.050)	-3.208*** (0.948)
Beef	8.799*** (2.255)	2.218*** (0.735)	-0.003 (0.924)	-2.557 (2.798)	2.408*** (0.885)	1.906*** (0.581)
Chicken	-4.323* (2.241)	-1.185 (1.320)	-3.327*** (1.210)	-5.597 (3.851)	-2.638** (1.247)	-0.655 (1.074)
Kapenta	-0.431 (0.739)	0.369 (0.280)	0.470 (0.333)	0.464 (1.204)	0.947* (0.522)	-0.170 (0.315)
Fish (bream)	1.424*** (0.428)	-0.135 (0.288)	0.919*** (0.285)	2.710* (1.570)	0.884** (0.365)	-0.049 (0.371)
Beans	-1.947** (0.931)	0.150 (0.362)	-1.622*** (0.470)	-2.773 (2.168)	-2.308*** (0.527)	1.185*** (0.429)
Eggs	-10.396*** (1.606)	-0.382 (0.909)	-1.595 (0.997)	-7.455* (4.333)	-1.958** (0.945)	-0.744 (0.884)
Milk (fresh)	-2.589*** (1.002)	-1.624** (0.731)	1.295*** (0.470)	-3.109 (2.967)	3.336*** (1.037)	0.197 (0.943)
Cooking oil	8.611*** (2.622)	1.196 (1.608)	0.810 (1.238)	0.614 (4.472)	1.386 (1.187)	2.071* (1.253)
Groundnuts	-0.226 (0.836)	0.083 (0.302)	0.860** (0.382)	4.539*** (1.101)	-0.453 (0.361)	0.709** (0.316)
Vegetables	-3.274*** (0.558)	0.358 (0.294)	-0.280 (0.327)	-0.898 (0.993)	-0.571* (0.324)	-0.008 (0.283)
Tomatoes	5.554*** (1.017)	0.889*** (0.283)	0.442 (0.417)	1.859* (1.018)	1.928*** (0.236)	0.085 (0.331)
Onion	-3.155*** (0.638)	-0.166 (0.181)	-0.497** (0.229)	-1.179 (1.220)	-0.804*** (0.277)	-0.129 (0.143)
Sugar	29.350*** (4.656)	5.308** (2.063)	0.710 (2.341)	-13.074 (8.859)	5.005*** (1.578)	4.327* (2.436)
District fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province-by-year terms	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	432	1,987	2,752	450	2,259	3,458
R-squared	0.111	0.055	0.054	0.176	0.063	0.059
Adjusted R-squared	0.030	0.038	0.042	0.104	0.048	0.049

Note Robust standard errors in parenthesis *** p<0.01, ** p<0.05, * p<0.1

Source Author's calculations based on LCMS (2006 and 2010) raw data and Central Statistical Office district price data.

significant from zero. This might be because rural mothers are generally less educated in comparison to mothers residing in urban areas, as observed in Table 1.

In rural areas, holding all other variables constant, the older the mother is, the better the child nutrition outcome. The most likely explanation here is that older mothers are better equipped to provide for their children. The effect in urban areas is not statistically significant.

Owning a radio is a positive determinant of children's nutrition outcomes in rural areas. The coefficients are not statistically significant for other household and community characteristics such as tap water, flush toilet and household size.

4.2 Food price effects by region

For the main variable of interest, food prices, the results show that the effect on children's height, holding all other variables constant, is dependent on the type of food commodity. The results in this article are only based on individual food commodities and are not aggregated into major nutrition groups such as cereals, proteins, and oil and fats. This is because, after running regressions on major nutrition groups, the results were largely statistically insignificant and the coefficients were too small to have any economic meaning. For this reason, the article focuses on individual food commodities only. This decision is also more informative for policymaking. Furthermore, the food prices are expressed in (natural) log terms, hence the coefficients are interpreted as semi-elasticities.

The results in Table 2 show that higher prices of maize products (refined and less refined maize flour) are associated with shorter children in both rural and urban areas. More specifically, a 10 per cent price increase of the more refined maize flour would reduce rural children's height-for-age z-scores by 0.36 units and by 0.23 units in urban areas. For an average child of 28 months old in the sample, these effects translate approximately into 1.29cm and 0.85cm reduction in height, respectively.⁷ Assuming that the average child remains in this growth curve, this further translates into a reduction of 2.6cm and 1.7cm in adult heights.⁸ In relation to the less refined maize flour, a price increase of 10 per cent is associated with a reduction in children's height-for-age z-scores of 0.07 units (0.25cm) and 0.17 units (0.63cm) in rural and urban areas, respectively.

The results for maize are somewhat surprising as the author would have expected that rural households would benefit from the rise in prices due to a higher proportion of rural households being net food sellers. An explanation for this finding could be that rural households sell some of the maize meant for consumption. Geier (1995) cited in Devereux (1996) made a similar discovery in Tanzania where the commoditisation of staple food crops undermined household food security and child nutrition. However, in the case of Zambia, it is also necessary to understand market interactions such as the presence of middle men who may be benefiting more from higher prices than the actual small-scale producers. Furthermore, the results for these two products show that households do not easily substitute from the staple crop, maize, to other starchy products such as cassava, once prices rise.

Considering that the household budget share of bread in urban areas is over double that of rural areas (Appendix 1), on average, it is not surprising that a rise in the price of bread only affects urban households. Specifically, a 10 per cent increase in the price of bread is associated with a 0.20 unit (0.71cm) reduction in children's height-for-age z-scores in urban areas. In rural areas, the effect is not significantly different from zero.

Regarding other nutrients, a 10 per cent increase in the price of eggs is associated with shorter children in both regions. Similarly, a rise in the price of beans is associated with a reduction in child health outcomes of up to 0.10 units (0.37cm) in rural areas. Though the coefficient is negative, the results are not statistically different from zero in urban areas. This result is also surprising as the author would have expected rural households to benefit from a rise in the price of beans due to their net selling capacity. However, this might also be an issue of food crop versus cash crop as suggested in the case of maize products.

Conversely, higher beef prices are associated with taller children in urban areas. This result could be explained by the substitution effect that may occur between chicken and beef. While the budget share (see Appendix 1) remained about the same for chicken between 2006 and 2010 (9 per cent and 8 per cent respectively), the budget share for beef reduced by three percentage points from 7 per cent to 4 per cent during the same period. A substitution of beef for chicken is beneficial for energy as each 100g of chicken⁹ contains 247 kilocalories in comparison to only 165 kilocalories in beef.¹⁰ Chicken also has higher fat and vitamin A content. However, with this substitution, children would lose out on higher traces of vitamin B6, vitamin B12 and zinc found in beef. Vitamin B6 is particularly important for boosting immunity as well as brain development during pregnancy and infancy. Due to this substitution link, it is a major concern that the coefficient of chicken in rural areas is negative and highly significant. Therefore, a 10 per cent increase in the price of chicken is associated with a reduction in children's health outcomes in both rural and urban areas by 0.20 units (0.71cm) and 0.17 units (0.61cm) respectively.

In their paper, Thomas and Strauss (1992) found that if the prices of dairy products rise by two standard deviations, then mean standardised height would decline by 2cm. Other food commodities that are associated with taller children when prices rise in Zambia include: fish, groundnuts, tomatoes and sugar in both regions and cooking oil in urban areas.

4.3 Household and community characteristics by gender and age

The rest of the results are based on a split sample by gender (Table 3) and by age (Table 4). In Table 3, the older the mother is, the better the health outcome for the male children in both regions. The results are insignificant for girls. In relation to maternal education, Table 3 shows that the education of the mother is positive and significant only for girls in urban areas. The results observed in Table 4 where the mother's education has a negative effect on children up to six months old in rural areas are surprising; perhaps this is influenced by mothers with low levels of education. As suggested by Thomas and Strauss

(1992) education has the biggest impact on the heights of children whose parents have some secondary education.

Furthermore, counter-intuitive results on flush toilets are observed in Table 4, which has a negative effect on the nutrition outcomes for children between six months and two years in urban areas. This result is unexpected but the coefficient could be influenced by other variables that are beyond the scope of this article. Table 3 also shows that the further away a health facility is, the worse off the nutrition outcomes are for girls. The coefficients are not statistically significant for the other groups.

4.4 Food price effects by gender and age

For some commodities, the nutrition effects once prices rise vary for boys and girls. In urban areas, Table 3 shows that a rise in the price of refined maize flour, chicken and beans is associated with shorter girls but the effect is not statistically different from zero for the boys. The opposite is true for eggs. A rise in the price of eggs is associated with shorter boys but the coefficient for girls in urban areas is not statistically significant. On the other hand, a rise in the price of bread is regressive for both boys and girls.

Results for the rural areas show that unlike boys, the rise in the price of refined maize flour, less refined maize flour and chicken is associated with shorter girls. However, an increase in the price of beans and onions negatively affects the health outcomes of both the girls and the boys. Table 4 disaggregates the results by age group. As expected, an increase in the price of milk decreases the height-for-age z-scores for children between six months and two years old in rural areas. The result is not surprising as this is the period children are weaned but are still dependent on milk for the relevant macro and micro nutrients. The same age group in urban areas, however, is positively affected by the rise in the price of milk. In rural areas, this age group is further affected by the rise in prices of breakfast mealie meal.

In urban areas an increase in the price of bread reduces the height-for-age z-scores for children between six months and five years. The effect is more precisely estimated for the older age group.

The nutritional outcomes of children below six months old in urban areas are negatively affected by an increase in the prices of rice and eggs. In rural areas on the other hand, a rise in the price of rice, bread, chicken, beans, eggs, milk, vegetables and onion negatively affects the health outcomes of infants who are under six months. These commodities are a reflection of the effect through maternal nutrition as children under six months would be too young to consume solid foods.

For the older age group (between two to five years old) in rural areas, their height-for-age z-scores lag behind the reference group if prices of commodities such as chicken, beans and both the refined and less refined maize flour increase.

5 Conclusions and policy implications

This article highlights the effects of an increase in various food prices on the height-for-age z-scores of children

under five. The results confirm the hypothesis that a rise in prices of food is indeed an important determinant for height-for-age z-scores (HAZ). Furthermore, they suggest that the level of importance varies across rural and urban areas, gender and age of the child.

The results show that the rise in prices of some food commodities has a negative effect on children's heights while others have a positive effect. In general, the estimated results in this article show that child height-for-age z-scores are negatively affected by an increase in the price of nutrient-dense foods such as chicken, beans and eggs.

The article suggests that the positive health outcomes associated with the rise in the price of commodities such as beef in urban areas are as a result of substitution with other products such as chicken, which has comparatively higher values for some nutrients.

These results depart from the findings of Thomas and Strauss (1992) who found that the rise in price of cereals had positive effects on rural children and in urban areas that a rise in the price of beans was associated with taller children. Instead, this article finds that a rise in prices of maize products and beans is associated with shorter children in both rural and urban areas. This is despite rural areas having more net sellers than urban areas. Nevertheless, these findings are somewhat similar to Christiaensen and Alderman (2004) on Ethiopia who found that higher teff prices are associated with shorter children. Likewise, in their research on the likely impact on Ugandan households of rising global food prices, Benson and Mugarura (2008) suggested that the quality of diets may suffer as families shift part of the income that they were initially spending on animal-source foods to purchase energy-dense cereals or tubers.

Given the extent of the negative effects of the increase in prices of food products on children's health outcomes, it is imperative to insulate the most vulnerable groups through appropriate policies. Sabates-Wheeler and Devereux (2010) suggested several ways in which social transfer interventions could be redesigned so that they are more responsive to food price variability such as a switch out of cash transfers towards food transfers when cash is devalued by prices or a combination of cash and food transfers. In addition and for the case of Zambia, a more integrated agriculture market system where information flows are enhanced and markets to sell the produce are readily available may offer more sustained positive health outcomes for children, especially those in rural areas.

Furthermore, in order to make agriculture work for poor households, the government must ensure the majority of the beneficiaries for the Farmer Input Support Programme (FISP), formerly called Fertiliser Support Programme, are poor households. Burke, Jayne and Sitko (2012) found that despite being framed as a key component of the nation's poverty reduction strategy, the FISP excludes the poorest households who cannot afford to pay the mandatory membership costs.

More broadly, the results in this article suggest that household dietary choices may not always be the most

Appendix 1 Household food budget shares by region

2006 Rural		2010 Rural		2006 Urban		2010 Urban	
Maize grain	0.15	Maize grain	0.16	Breakfast mealie meal	0.09	Roller meal	0.08
Cooking oil	0.09	Vegetables	0.13	Chicken	0.08	Vegetables	0.08
Chicken	0.08	Cassava	0.08	Bread	0.07	Bread	0.08
Fish	0.08	Chicken	0.05	Cooking oil	0.07	Chicken	0.08
Sugar	0.07	Hammermill maize flour/pounded maize	0.04	Vegetables	0.06	Cooking oil	0.05
Cassava	0.06	Cooking oil	0.04	Beef	0.06	Maize grain	0.05
Kapenta	0.06	Sugar	0.04	Fish	0.06	Sugar	0.05
Salt	0.05	Fish	0.04	Sugar	0.06	Beef	0.04
Beans	0.04	Kapenta	0.03	Kapenta	0.05	Kapenta	0.04
Tomatoes	0.03	Bread	0.03	Tomatoes	0.05	Fish	0.04
Vegetables	0.03	Dried beans	0.03	Rice	0.04	Tomatoes	0.04
Bread	0.03	Fruits	0.03	Beans	0.03	Rice	0.04
Groundnuts	0.03	Tomatoes	0.03	Maize grain	0.03	Dried beans	0.03
Rice	0.03	Breakfast mealie meal	0.02	Roller meal	0.03	Fruits	0.03
Beef	0.03	Bream	0.02	Eggs	0.03	Bream	0.03
Goat meat	0.02	Roller meal	0.02	Onion	0.02	Eggs	0.03
Pork	0.02	Groundnuts	0.02	Fresh milk	0.02	Onion	0.02
Onion	0.01	Salt	0.02	Non-alcoholic drinks	0.02	Breakfast mealie meal	0.02
Game meat	0.01	Beef	0.02	Irish potatoes	0.02	Milk fresh	0.02
Fresh milk	0.01	Rice	0.02	Groundnuts	0.01	Cassava	0.01
Eggs	0.01	Non-alcoholic drinks	0.01	Salt	0.01	Potatoes	0.01
Millet	0.01	Onion	0.01	Tea/coffee	0.01	Groundnuts	0.01
Hammermill maize flour/pounded maize	0.01	Sweet potatoes	0.01	Butter	0.01	Wheat	0.01
Non-alcoholic drinks	0.01	Fresh beans	0.01	Hammermill maize flour/pounded maize	0.01	Hammermill maize flour/pounded maize	0.01
Sorghum	0.01	Goat meat	0.01	Fruits	0.01	Sweet potatoes	0.01
Breakfast mealie meal	0	Milk fresh	0.01	Pork	0.01	Salt	0.01
Irish potatoes	0	Eggs	0.01	Cassava	0.01	Butter	0.01
Tea/coffee	0	Millet	0.01	Goat meat	0.01	Pork	0.01
Roller meal	0	Game meat	0.01	Game meat	0.01	Tea	0.01
Honey	0	Pork	0.01	Powdered milk	0	Goat meat	0.01
Sweet potatoes	0	Wheat and wheat products	0.01	Sweet potatoes	0	Game meat	0.01
Fruits	0	Potatoes	0	Other poultry	0	Fresh beans	0.01
Total shares	0.99		0.98		1		0.98

Source Author's calculations based on LCMS (2006 and 2010) raw data.

nutritious, given the price effect. Therefore, low-cost interventions such as regular community-based nutrition education, which could be integrated within the Ministry of Health, should be implemented. For maximum benefits, this type of education should be tailor-made for districts by taking into account the locally available food commodities and providing information on the precise

nutrition contents based on the nutrition tables from Zambia's National Food and Nutrition Commission.

Finally, the article argues for more investment in regular household surveys to enhance evidence-based policymaking and more importantly, ensure timely targeted responses when households face covariate shocks.

Notes

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- 1 Calculated by author using monthly retail price data collected by the Zambian government's Central Statistical Office (CSO).
 - 2 Sardine-like small fish.
 - 3 Deaton (1989) defines NBR as the value of net sales of a commodity as a proportion of income.
 - 4 The cereal products used to calculate the NBR estimates are maize, rice, cassava, millet and sorghum.
 - 5 Each district has an average of 190 households. More information about the rationale for selecting these districts is in the data section.

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- 6 The 39 districts are representatives of all nine provinces.
- 7 One standard deviation in the CDC distribution at this age corresponds approximately to 3.6cm.
- 8 One standard deviation in the CDC distribution at the age of 20 is 7.2cm for boys and 6.5cm for girls.
- 9 The nutrition contents are based on a fresh boiled chicken containing a neck, meat and skin; and boiled lean beef.
- 10 A substitution of beef for chicken could be beneficial for poor households who may mostly consume lean rather than high fat beef. In comparison to lean beef with only 165 kilocalories, energy levels in each 100g of chicken is higher (247 kilocalories). Chicken also has higher vitamin A and calcium content (NFNC 2007).

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Does Exposure to Aflatoxin Constrain Efforts to Reduce Stunting in Zambia?

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Abstract On 8 June 2013, the Vice President of Zambia stated that his government ‘is fully committed to reducing chronic undernutrition by 50 per cent in the next ten years...’ What are the challenges to meeting this goal? Zambia has both a high consumption of groundnuts and high levels of aflatoxin contamination of this commodity. Recent studies indicate an association between stunting and aflatoxin exposure. If the association exists, then Zambia faces serious challenges to reaching its target of 50 per cent reduction in chronic undernutrition. Recent efforts to identify atoxigenic strains for biocontrol in maize and groundnuts give cause for cautious optimism. Nonetheless, the challenges ahead demand both a high level of political will to achieve effective multisectoral collaboration and the willingness of the agricultural and health sectors to undertake rigorous monitoring of aflatoxin contamination and growth of young children, as well as the agricultural sector’s commitment to reduce substantially levels of aflatoxin contamination and to promote agricultural diversification.

1 Introduction

The prevalence of chronic malnutrition (stunting) in Zambian children is very high: 45 per cent among children under five years of age (ZDHS 2009). On 8 June 2013, the Vice President of Zambia stated that his ‘government is fully committed to reducing chronic undernutrition by 50 per cent in the next ten years...’¹ Is this achievable? What are the challenges to meeting this goal?

The consequences of chronic malnutrition during childhood have serious implications for national development. A child that suffers early linear growth retardation is likely to suffer also from poor cognitive development and poor performance at school. Poor school achievement can lead to a lowered ability to earn an adequate income. A short child is likely to become a short adult, with reduced physical productivity and, in women, a greater risk of poor pregnancy outcomes, including low birth weight babies. Moreover, an adult who is short because of nutritional insults experienced during foetal or early childhood is at greater risk of obesity, coronary heart disease, diabetes and hypertension, especially when exposed to relative affluence later in life (Barker 1997). This has major implications for the cost of health care in countries undergoing economic transition.

Data on the length of newborns in Zambia are sparse. However, while the prevalence of stunting is highest among children aged 18–23 months, it is notable that 18 per cent of children under six months are already chronically malnourished (ZDHS 2009). This suggests that linear growth retardation is likely to have occurred either during pregnancy or during early infancy, or both.

A high prevalence of chronic malnutrition is linked to poor nutrition and high morbidity. Hence interventions focused on improving child feeding practices, increasing access to a more diverse weaning diet, and improving hygiene

practices and access to health care are of paramount importance. But there is now growing interest in the link between stunting and exposure to aflatoxin. It seems that even with full coverage of a wide range of health and nutrition interventions, only 36 per cent reduction in stunting is achievable (IFPRI and BMGF 2012). In Zambia, with its high consumption of maize and groundnuts, a significant proportion of the remaining 64 per cent may be attributed to the impact of exposure to aflatoxin-contaminated foods.

This article discusses: (1) findings of studies linking aflatoxin exposure to linear growth retardation in young children; (2) aflatoxin contamination levels in maize and groundnuts in Zambia, and mitigation strategies; and (3) the need for a multisectoral approach in order to reduce aflatoxin exposure, improve diet diversity and reduce the prevalence of stunting among Zambian children.

2 Aflatoxins and malnutrition

Aflatoxins are fungal metabolites, and toxic contaminants of a wide range of food crops. In Africa generally, and in Zambia especially, key dietary crops at risk of contamination, largely as a result of climatic conditions and poor storage practices, are maize and groundnuts. The role of aflatoxins as potent inducers of liver cancer and as causative agents of impairment of the immune system is well established (Wild and Gong 2010).

Studies from the early 1970s established the association between aflatoxin exposure and growth impairment in animals (Khangwiset, Shephard and Wu 2011). Beginning in the early 1980s, a number of small studies investigated links between kwashiorkor (a form of severe malnutrition) and aflatoxin exposure in young children (Lamplugh and Hendrickse 1982; Oyelami *et al.* 1997; Khangwiset *et al.* 2011). These studies concluded that while a link existed, it was likely that impaired liver function in children with

kwashiorkor led to differences in how aflatoxins were metabolised, rather than the aflatoxins themselves causing kwashiorkor (Lamplugh and Hendrickse 1982).

More recently, studies from Africa and the Middle East have strongly suggested a close link between exposure to aflatoxins and growth impairment in neonates and young children (Gong *et al.* 2002, 2003, 2004; De Vries, Maxwell and Hendrickse 1989; Abdulrazzaq *et al.* 2003, 2004). Aflatoxins have been detected in maternal blood, cord blood and breast milk, and associations have been demonstrated with birth weights and birth lengths.

In Kenya, aflatoxins were found in the blood of more than half the mothers studied, and the mean birth weight of the infants born to these mothers was significantly lower than that of infants born to non-contaminated mothers (De Vries *et al.* 1989). In Benin and Togo, aflatoxins were detected in the blood of almost all study children (aged 9–60 months), with the level of contaminant showing regional variation (Gong *et al.* 2003; 2004). In these studies, blood aflatoxin levels rose significantly up to the age of three years, were higher in children who had stopped breastfeeding, and were correlated with maize consumption but not with groundnut consumption. There was a strong dose-response relationship between blood contamination levels and the degree of stunting. Stunted children (with height-for-age z-scores less than -2 SD below the median reference value) had 30–40 per cent higher contamination levels than non-stunted children.

In summary, recent studies, mostly from Africa and the Middle East, suggest that children's exposure to aflatoxins can be high during pregnancy from maternal exposure, followed by exposure in infancy and early childhood through contaminated breast milk and complementary foods. While a causal link between aflatoxin exposure and stunting has not yet been fully established, a strong association between the two conditions seems very likely. Further studies are needed to investigate more fully the nature and mechanism of the association, but there is sufficient evidence to indicate the need for appropriate interventions.

3 Aflatoxin contamination and mitigation in Zambia

Research on aflatoxin contamination of food commodities started around the 1970s with variable levels reported, ranging from 0ppb to >900ppb in maize (Marasas *et al.* 1977; Njapau, Muzungu and Changa 1998; Kankolongo *et al.* 2009; Mukanga *et al.* 2010). Currently, under the US Agency for International Development (USAID) Feed the Future aflatoxin mitigation project, the International Institute of Tropical Agriculture (IITA) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in partnership with other stakeholders are undertaking research on monitoring and mapping the prevalence of aflatoxins in maize and groundnuts in Eastern Province, Zambia. Preliminary results indicate that aflatoxin contamination of maize at harvest is low, ranging from 0–11ppb with 99 per cent of maize samples having aflatoxin levels below the acceptable international standard of 4ppb. However, aflatoxin levels were higher in samples that had been stored for up to three months, and varied with the types and conditions of storage and storage facilities. Nevertheless, the exposure of people is likely to

be high in spite of the low contamination levels found in maize in a single year sampling. This is because maize consumption is substantial in most parts of Zambia (121–140g maize/person/day) leading to high exposure despite low contamination levels.

The situation with groundnuts, however, is more serious. Levels of contamination of groundnuts are much higher: in peanut butter samples from supermarkets a mean of 53ppb were found as compared to a mean of 12ppb in grain samples from local markets (ICRISAT n.d.). Levels as high as 1,000ppb have been found in peanut butter, while levels up to 5,350ppb were observed in peanut samples collected at harvest (IITA n.d.). Again, in most cases the contamination levels found in the pre-harvest groundnut samples tend to rise during storage. Sorting of groundnuts to identify and reject bad nuts can reduce human exposure to aflatoxins, but the discarded nuts are often fed to chickens and other animals, thus re-entering the food chain. Moreover, in poorer households these non-marketable nuts may be consumed by the family.

Clearly, aflatoxin contamination of maize and groundnuts has wide-ranging national and household-level economic and food security implications for Zambia, in addition to its implications for health and nutrition. Standards for permissible aflatoxin levels vary across countries, regions and food commodities. Those imposed in Europe, the most important region for exports for many African countries, are among the most stringent (Wu *et al.* 2011). A World Bank study estimated that application of the European standards costs Africa US\$750 million each year (Fapohunda 2009). Efforts to reduce contamination are thus important for a number of reasons.

Trials are under way, in Zambia and elsewhere, to search for optimal approaches to mitigation. These include better cropping and harvesting practices, improved storage facilities, sorting (of groundnuts) in conjunction with public education (regarding disposal of rejected nuts), rigorous application of the accepted standard of contamination by international and local commercial markets, switching to resistant varieties, and detoxification of foods (Waliyar *et al.* 2013). The use of aflatoxin biocontrol agents is an approach that has considerable potential. Biocontrol technology uses the ability of native atoxigenic strains to outcompete aflatoxin-producing strains (Bandyopadhyay and Cotty 2013). Further research is needed into the potential of crop rotation in aflatoxin control (ICRISAT n.d.).

Groundnuts are an important source of protein and a number of vitamins and minerals for children in Zambia. In 2007 (ZDHS 2009), for example, 40.5 per cent of children aged 6–23 months had consumed groundnuts on the day before the survey. Asking mothers to withhold groundnuts from their children's diets is therefore not an acceptable solution nutritionally, unless we are able to offer an appropriate alternative commodity that is equally nutritious and low in cost.

While a causal link between exposure to aflatoxins and foetal, infant and young child linear growth retardation has not been fully established, there is enough evidence of

an association to propose the need for appropriate action. Moreover, interventions to improve young child feeding practices, especially by increasing access to a more diverse diet for complementary feeding, can also make an important contribution to reducing stunting. Such actions demand the close collaboration of, at the very least, the agricultural and health sectors.

If even universal coverage of a comprehensive package of health and nutrition interventions can only achieve a 36 per cent reduction in the prevalence of stunting, then clearly Zambia's target of a 50 per cent reduction will not be achieved by 2023 (IFPRI and BMGF 2012). Can agriculture help us to reach the target, by reducing exposure to aflatoxins and by improving access to a more diverse diet for complementary feeding?

The current situation of Zambia in relation to nutrition is mixed. On the one hand, nutrition in general, and the challenge of stunting in particular, is enjoying unprecedented attention from donors and from the government. An early signatory to the Scaling Up Nutrition initiative, Zambia is currently implementing the First 1000 Most Critical Days Programme. At the recent Nutrition for Growth Event in the UK in 2013, the Vice President of Zambia pledged to:

- Reduce stunting by 50 per cent by 2023;
- Resolve human resource and financial gaps in key line ministries;
- Increase government expenditure on nutrition to reach the estimated US\$30 per child under five;
- Encourage private sector involvement to enable access to affordable and appropriate nutritious foods; and
- Strengthen the governance and coordination mechanisms of the nutrition sector by direct oversight of progress by the Vice President's office – and strengthen line ministries' and the National Food and Nutrition Commission's functioning and accountability.²

However, important though these public pronouncements are, Zambia's human resources available to implement national nutrition programmes and policies are woefully inadequate. And this inadequacy may ultimately be the single most important constraint to successful multisectoral collaboration and nutrition interventions.

There are two important recent initiatives in relation to human resources for nutrition. Firstly, the UK's Department for International Development (DFID) has recently funded a nutrition workforce planning consultancy, an action welcomed by relevant government officials. The report of the consultancy will provide up-to-date figures on nutritionists in Zambia, their levels of training and their tasks. Hopefully, this will be seen as an opportunity to rationalise the roles and qualifications of nutritionists, and raise the profile of nutrition in Zambia.

Secondly, in 2011, the University of Zambia began the BSc in Human Nutrition, the first degree level programme in human nutrition in Zambia. The University is also preparing to offer an MSc in Human Nutrition. Both the BSc and the planned MSc demand considerable financial support and commitment from donors and from the University itself in order to become fully established and sustainable.

A recent review of the readiness of Zambia to move forward with significant efforts to address its food and nutrition problems, states that:

Zambia is an ideal candidate for a country that could make a significant impact on its malnutrition problem. With the emergence of the Scaling Up Nutrition (SUN) movement in the country, nutrition has received some high-level political attention, and the multisectoral nature of nutrition is recognised in overarching development policies and strategies. However, political attention has not moved into concrete action, and nutrition strategies, policies, and plans are essentially wish lists noting best practice, confined mainly to the health sector, created with substantial input from external actors, and without the backing of political commitment, budgetary or human resources, or capacity; implementation of these grand ideas is severely lacking (Harris and Drimie 2012).

4 Reducing exposure to aflatoxins and reducing stunting in Zambia: a holistic approach?

Turning back to the question of aflatoxin contamination of groundnuts and maize, and its likely impact on child growth, we need to consider how Zambia can effectively address the issue. The first requirement is that the health and agriculture sectors accept the recent findings of aflatoxin levels in maize and groundnuts in Zambia, and the likely association between aflatoxin contamination and stunting demonstrated in other countries. Certainly confirmation of these findings in Zambia is an important area of further research, as are other research areas such as exposure assessments and pilot studies to assess whether reducing aflatoxin exposure can indeed prevent stunting. We need also to further test ways to reduce the aflatoxin contamination, so as to identify the most cost-effective strategies.

Ultimately though, if we are to achieve a significant impact on childhood malnutrition, we need a holistic approach, an approach that brings together a range of relevant interventions, not all of which concern aflatoxin contamination:

- Reducing the level of aflatoxin contamination of maize and groundnuts;
- Updating legislation that controls the level of permissible contamination of groundnut and maize products in the commercial markets, and strong enforcement of such legislation;
- Conducting public awareness and education campaigns to improve compliance with recommendations for reducing aflatoxin contamination, improving child nutrition and reducing morbidity.

In addition to aflatoxin control, if stunting levels are to be significantly reduced, it will be vital to address the other underlying determinants of stunting:

- Improving economic and physical access to a more diverse diet, especially by poorer households;
- Improved breastfeeding and child feeding practices;
- Improving water supplies and sanitation, and upgrading programmes to reduce morbidity.

Another important component of any holistic approach is the rigorous monitoring and impact evaluation of the interventions. The Ministry of Agriculture and Livestock must undertake to test aflatoxin levels in pre-harvest and post-harvest groundnut samples and products on a regular basis, and the Ministry of Health and the Ministry of Community Development and Maternal and Child Health must adequately monitor the growth of children. Currently, Zambia's growth monitoring programme measures only the weights of children. Difficult as it may be, the programme must be expanded to include the measurement of lengths and heights. Concerns with aflatoxin contamination aside, it is unacceptable that in a country which claims to want to halve its seriously high level of stunting, stunting is not even recognised as a condition requiring attention by health staff in district health centres. By measuring only weight, health staff are failing to recognise the onset of stunting and may be offering inappropriate advice to mothers. Stunting is irreversible; it needs to be recognised early and prevented, not treated.

The holistic approach described above is daunting for a country facing the major human resource constraints that challenge Zambia. It requires serious commitment by the

agriculture, health and education sectors to achieve the essential collaboration. A substantial number of nutrition projects or nutrition-sensitive health and agricultural projects are under way, mostly conducted by non-governmental organisations (NGOs) or international agencies. One approach would be to add components to these existing intervention projects to achieve the desired holistic approach. Another possibility, a phased approach in selected districts and provinces, is strongly recommended, with intersectoral collaboration promoted at community and district levels, and not just at national levels. In line with this approach, DFID is supporting the development of multisectoral nutrition plans in the 14 first phase districts of Zambia's Scaling Up Nutrition First 1000 Most Critical Days Programme.

However the reduction of exposure to aflatoxins and the reduction in the prevalence of stunting are to be achieved, efforts must be accompanied by substantial investment in capacity building at all levels. Access by all Zambians to a nutritionally adequate and safe food supply is a human right, and an essential prerequisite for successful and equitable national development.

Notes

- 1 Nutrition for Growth Event held in 2013, hosted by DFID, the Government of Brazil, and the Children's Investment Fund Foundation.
- 2 *Ibid.*

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The Role of Fish in the First 1,000 Days in Zambia

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Abstract Fish is especially rich in essential omega-3 long-chain polyunsaturated fatty acids and micronutrients, including bioavailable calcium, iron and zinc. Fish features prominently in the diet of most, especially poor, Zambians. Despite this, its significance in the diet of women and children in the first 1,000 days is not well understood. Our current knowledge of the nutrient content of commonly consumed fish species in Zambia is synthesised. The importance of fish in food and nutrition security of rural and urban households and the impact of intra-household distribution on nutrient intake from fish, especially among pregnant and lactating women and children 6–23 months of age, are explored in this article. Key knowledge gaps are identified, and research priorities are highlighted. Recommendations are provided on policy, communications and technological initiatives to maximise the role fish can play in the First 1000 Most Critical Days Programme in Zambia.

1 Introduction

Zambia is particularly well endowed with surface water resources, most of good environmental quality, and which provide fish and other aquatic foods, mainly from capture fisheries¹ (Nkhuwa, Mweemba and Kabika 2013). Fish is the most important animal-source food in the diet of many people (NFNC 2009), and dried small fish is thought to be the most common animal-source food of the poor, cooked as a relish and eaten with *nshima* (a thick porridge, normally made from maize flour, but also from millet, sorghum or cassava flour or any one of these combined with maize flour). However, the quantity and frequency of fish consumption are small, especially among women and young children. The diet in Zambia is dominated by the staple crop, maize, and has little dietary diversity. Although consumption of dark green leafy vegetables is relatively high, consumption of other micronutrient-rich foods such as yellow/orange vegetables, animal-source foods and fruits is comparatively small (*ibid.*).

In Zambia, rates of malnutrition in children under five years are very high, with stunting, wasting and underweight all falling well above the thresholds recommended by the World Health Organization (*ibid.*). The 2009 National Nutrition Surveillance System (NNSS) results show that chronic malnutrition, as measured by stunting (height-for-age < -2 z-scores), was 49.5 per cent in children under five years of age. Rates of malnutrition among children aged 6–11 months were found to be strikingly high, raising concerns about breastfeeding and complementary feeding practices: 26 per cent of girls and 38 per cent of boys were stunted, and 9 per cent and 8 per cent of girls and boys respectively were wasted in this age group. Underweight (BMI < 18.5) among women of reproductive age (15–49 years) was found to be 11 per cent in rural areas and 7 per cent in urban areas (*ibid.*). Increase in the consumption of micronutrient-rich foods,

fish, other animal-source foods, vegetables and fruits in the first 1,000 days of life² can help combat malnutrition.

Fish is a rich source of multiple nutrients with high bioavailability;³ all species of fish are rich in protein, while some species have particularly high levels of essential fatty acids and micronutrients, including calcium, iron and zinc (Beveridge *et al.* 2013). Thus, fish offers an important source of key nutrients required by pregnant and lactating women and young children for optimal child growth and development. However, the present per capita fish supply in Zambia is low, 5.9kg/capita/annum (7.2kg, if net imports of fish are included) in 2011, having decreased by 50 per cent since 1970 (see Table 1).⁴ This dramatic decrease in fish supply is likely due to a combination of factors including rapid population growth, declining capture fisheries, and an aquaculture sector⁵ that has yet to fulfil its potential.

This article reviews the data currently available on the importance of fish in the first 1,000 days of life and proposes various ways in which fish can be more effectively integrated in the First 1000 Most Critical Days Programme in Zambia. This is a national programme, aligned to the Scaling Up Nutrition (SUN) initiative, developed to address undernutrition through the coordinated involvement of relevant sector line ministries and multiple stakeholders.

2 Fish consumption in Zambia

Data from the 2009 NNSS report (NFNC 2009) show that, at household level, fish was the most commonly consumed animal-source food; fish was eaten by 41 per cent of households in the preceding 24 hours of the survey, whereas meat was eaten by 28 per cent of households (see Figure 1). In terms of frequency of consumption of food groups in the week preceding the survey, fish was the most

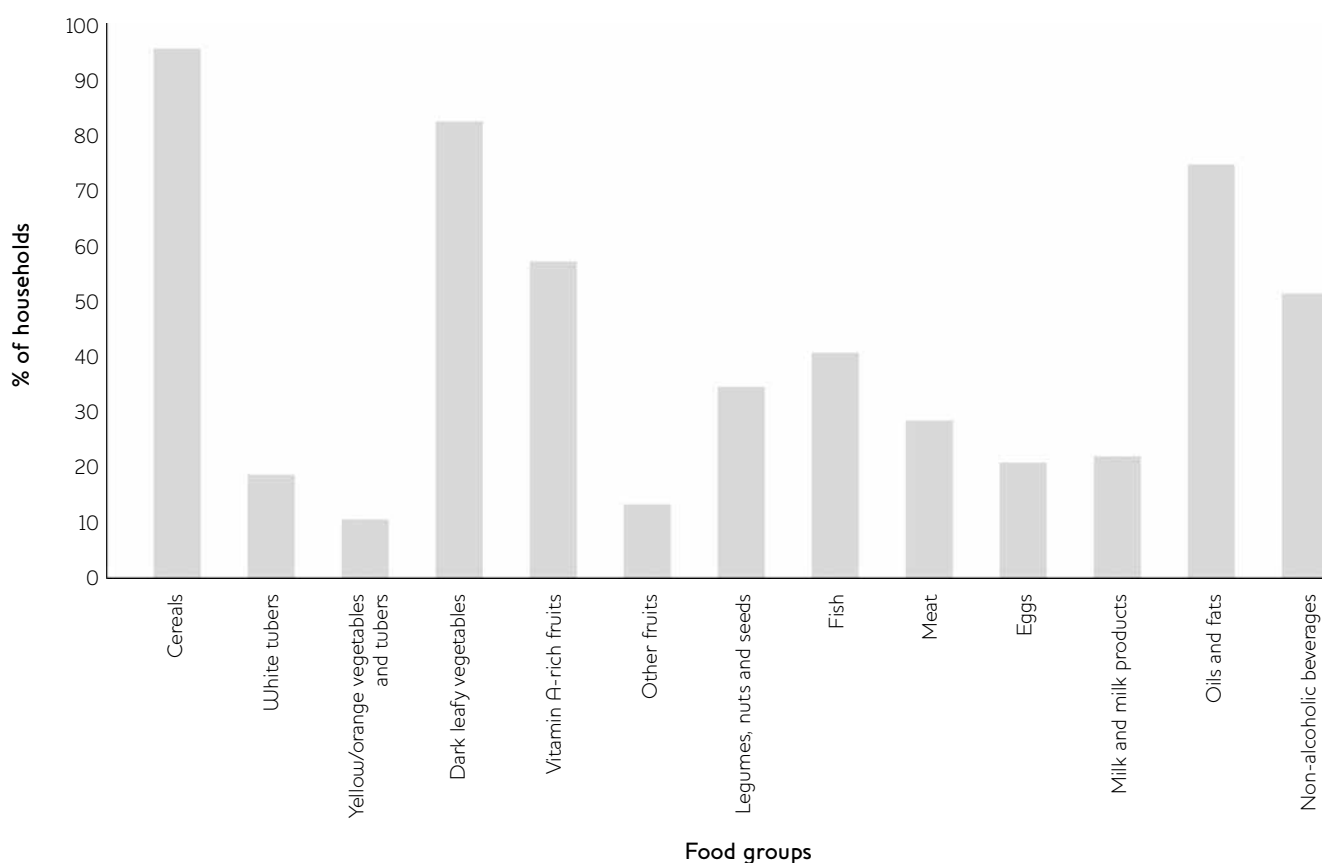
Table 1 Fish supplies in Zambia, 1950–2011. Per capita fish supplies are calculated on the basis of capture and culture production; figures in parenthesis include net fish imports

Year	Population ¹ (millions)	Fish supply				
		Capture (tonnes)	Culture (tonnes)	Net imports (tonnes)	Total (tonnes)	Per capita (kg/capita/year)
1950	2.34	10,000				4.27
1955	2.56	17,500				6.83
1960	3.05	19,500				6.4
1965	3.54	40,100				11.34
1970	4.14	52,100				12.59
1975	4.90	57,426				11.72
1980	5.78	50,988	27	2335	51,015	8.83 (9.24)
1985	6.79	68,000	363	250	68,363	10.08 (10.11)
1999	7.86	64,868	1,460	951	66,328	8.44 (8.56)
1995	8.92	70,546	4,081	206	74,627	8.37 (8.39)
2000	10.20	66,671	4,240	2,037	70,911	6.95 (&.15 ²)
2005	11.46	65,927	5,125	6828	71,052	6.2 (6.79)
2010	13.09	76,396	10,291	3682	86,687	6.62 (6.90)
2011	13.46	69,364	10,530	15922	79,894	5.94 (7.12)

Notes (1) Population size in 2011 was estimated based on an average annual population growth rate of 2.8 per cent from 2000 to 2010 (CSO 2012); (2) *sic*.

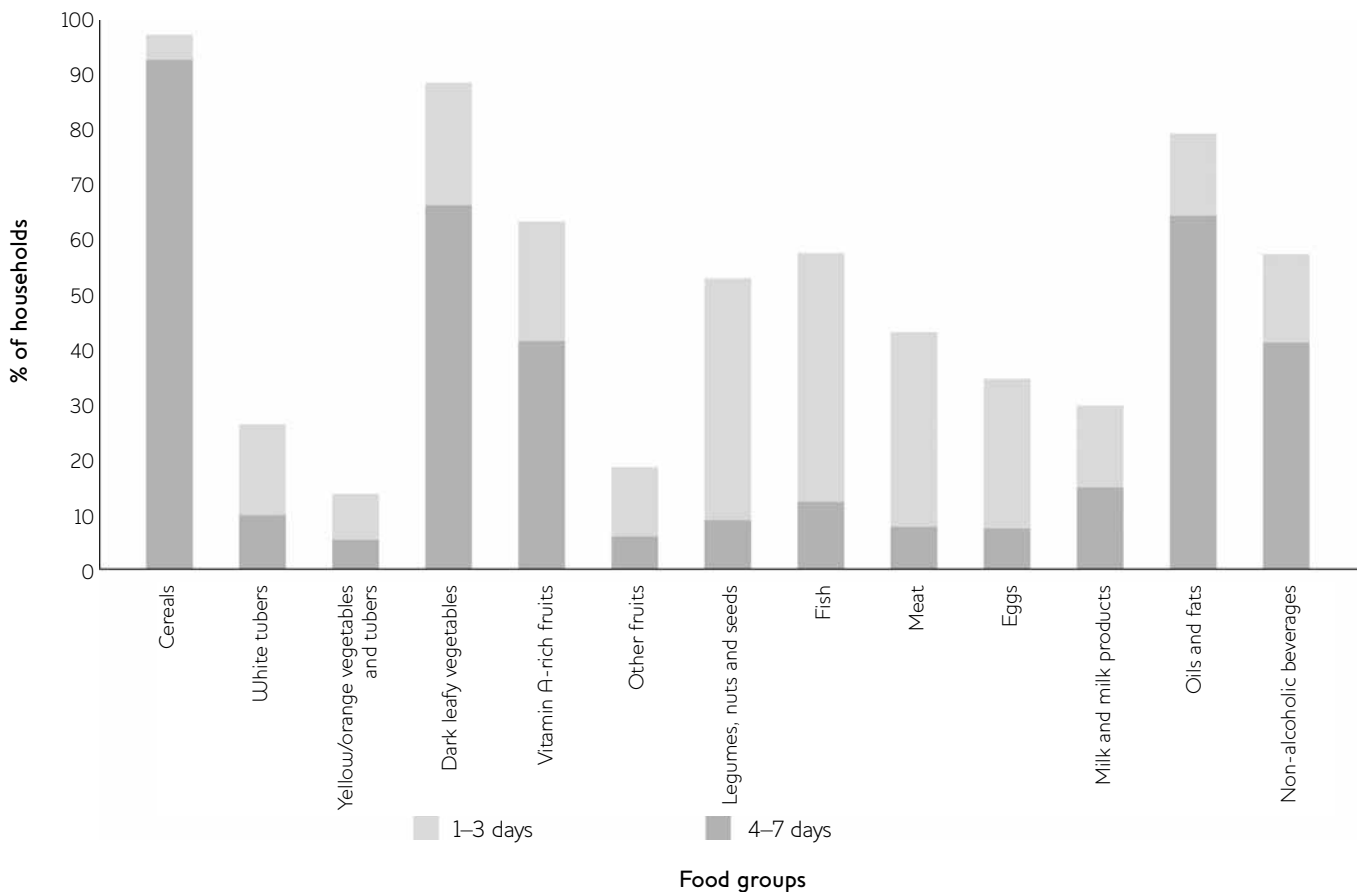
Source FAO (2013a); FAO (2013b).

Figure 1 Percentage of households (n=9565) consuming different food groups in the preceding 24 hours of the survey



Source Based on data from the 2009 National Nutrition Surveillance System report (NFNC 2009).

Figure 2 Percentage of households (n=9565) that had eaten different food groups on 1–3 days or 4–7 days in the preceding week of the survey



Source Based on data from the 2009 National Nutrition Surveillance System report (NFNC 2009).

frequently consumed animal-source food; 45.1 per cent and 12.3 per cent of households ate fish for 4–7 days and 1–3 days respectively, whereas 35.6 per cent and 8.2 per cent ate meat for 4–7 days and 1–3 days, respectively (see Figure 2). Findings from urban consumption patterns for livestock products show that better-off households consume relatively well-balanced shares of different animal-source food products (including fish), whereas poorer households predominantly consume fish (37 per cent share) and much smaller shares of meat and poultry (24 per cent and 22 per cent, respectively), and dairy items (11 per cent) (Hichaambwa 2012).

The majority of fish consumed in Zambia comes from capture fisheries (see Table 1) and includes small pelagic species known as *kapenta* and *chisense* which are usually sun-dried whole, although various other post-harvest methods such as dry salting, brining, freezing and mechanical-drying may be applied in various combinations (Mutsekwa 1992). *Kapenta* is a mixture of *Limnothrissa miodon* and *Stolothrissa tanganicae* and found in Lake Kariba, Lake Tanganyika and Lake Itzhi-Tezhi. *Chisense* is a mixture of *Potamothrissa acutirostris*, *Microthrissa stappersii* and *Poecilothrissa moeruensis* and caught in Lake Bangweulu, Lake Mweru and Lake Mweru-wa-Ntipa. Several tilapia species (breams) are eaten both fresh and dried and catfish feature prominently among fish consumed. Fish supply is highly seasonal, with fish from capture fisheries being most available from March to November. *Chisense* and *kapenta* production dips in June–July, whereas this is the period of

peak productivity for the larger breams (Ndebele-Murisa, Mashonjowa and Hill 2011). The very small amounts of cultured (farmed) fish consumed include indigenous tilapia species and exotic species such as Nile tilapia (*Oreochromis niloticus*) and common carp (*Cyprinus carpio*).

Dried *kapenta* and *chisense* consumption, particularly by the poor, is affected by many factors such as price, location, season, availability and access. It is not known whether dried small fish is preferred to large, fresh fish, or if fish consumption preferences are gendered, or if fish is preferred to other animal-source foods. However, dried small fish is highly accessible to the poor as it can be bought at local markets in small quantities at low cost, and transported and stored relatively easily. Dried *kapenta* and *chisense*, cooked as a relish, are believed to be divided more evenly among family members than larger fish or other animal-source foods (Banda Nyirenda, Sampa and Hüsken 2010). Thus, increasing household access to and consumption of dried small fish in comparison to large fish and other animal-source foods may have a larger positive effect on intake of essential nutrients in the first 1,000 days of life.

3 Nutrient content of commonly consumed fish species in Zambia

Table 2 shows the composition of selected essential nutrients in sun-dried *kapenta* and *chisense*. As these small fish are dried whole, with heads, bones and organs, they are a concentrated source of multiple essential nutrients.

Table 2 Nutrient composition¹ of sun-dried *kapenta* and *chisense* (per 100g) from the Rift Valley, Africa

	Calcium (mg)	Iron (mg)	Zinc (mg)	Retinol ² (RAE)	Protein (g)	Fat (g)	EPA ³ (g)	DHA ³ (g)
<i>Chisense</i> (Lake Mweru-wa-Ntipa)	2146	7	13	287	63	9	0.64	0.79
<i>Kapenta</i> (Lake Tanganyika)	2138	14	10	72	61	12	0.77	0.86
<i>Kapenta</i> (Lake Kariba)	2796	9	14	198	66	6	0.45	0.68

Note (1) Nutrient composition of sun-dried fish was estimated based on dry matter content. (2) Vitamin A of the sun-dried fish was measured as retinol, dehydroretinol was not measured. (3) Eicosapentaenoic acid (EPA, 20:5(n-3)) and docosahexaenoic acid (DHA, 22:6(n-3)) was estimated based on total fat content and fatty acid composition.
Source Steiner-Asiedu *et al.* (1993).

Calcium content is especially high, and the calcium found in fish is as bioavailable to humans as calcium from milk (Hansen *et al.* 1998). The content of iron and zinc is also both high and highly bioavailable (Roos *et al.* 2007). The vitamin A content of these fish is presumably higher than the values given for retinol alone, as it is well known that in fish vitamin A occurs as both retinol and dehydroretinol (Kongsbak, Thilsted and Wahed 2008). Studies have shown that dehydroretinol has similar physiological effects as retinol, for example on eye function (Riabroy, Dever and Tanumihardjo 2013).

Sun-dried *kapenta* and *chisense* are also rich sources of the essential long-chain polyunsaturated fatty acids eicosapentaenoic acid (EPA) and docosohexaenoic acid

(DHA), which are crucial for brain development and cognition of the child in the first 1,000 days of life (Innis 2007; Michaelsen *et al.* 2011).

As large fish are not eaten whole, they do not contribute to micronutrient intake as small fish do. Also, there are species differences with respect to micronutrient content, and analyses of fish from Bangladesh and Cambodia have shown that the edible parts of some small fish species are particularly rich in vitamins and minerals compared to the edible parts of cultured large fish species (Thilsted 2012a).

Unlike plant-source foods, fish does not contain inhibitors (e.g. phytic acids and oxalates) of bioavailability of micronutrients. Moreover, fish and other animal-source

Table 3 Reported age at which complementary foods were introduced to children^{1,2}

Foods	Age group (months)					
	<3	3–5	6	7–9	10–12	>12
Water	12	21.8	61	4	0.1	1.9
<i>Nshima</i> ³	1.7	9.4	43	37.8	4.5	3.3
Other starchy foods	1.6	8.1	34	44.5	7.7	4
Yellow/orange/red vegetables	1.8	5.2	25	43.9	15.3	8.6
Green leafy vegetables	2.2	5.3	27	46.1	13.9	5.5
Yellow/orange fruits	1.4	5.4	29	42.2	15.3	7.3
Other fruits	1.1	4.3	9.6	22.9	36	26
Legumes, beans, lentils	1.5	5.1	30	45	13.3	5.1
Peanuts, groundnuts, bambara nuts, other nuts	3.9	10.6	45	23.9	9.2	7.5
Small fish (e.g. <i>kapenta</i> , <i>tutika</i>)	2.1	10.6	46	31.2	5.5	4.7
Large fish	1.2	6.4	22	33.8	22.4	14
Meat (beef, goat, pork)	1	4.4	9.5	23.6	36.6	25
Chicken, duck, other poultry	1	5	14	28.4	32.2	19
Eggs (e.g. chicken, duck)	2.1	8	46	23.9	9.1	11
Milk (cow, goat, sour milk, powdered milk)	1.4	4.3	29	28.2	21.9	16
Purchased snack foods	1.4	4.4	28	11.3	7.9	4.7

Note (1) Number of children: 3,036, age 24–59 months. (2) Data presented are percentages of children who were introduced to different food groups in different age categories. (3) *Nshima*: porridge, normally made from white maize flour, or a mixture of maize and cassava flour, cooked with water.

Source Harris *et al.* (2012).

Table 4 The contribution of different food groups and breast milk to the intake of energy and nutrients in young children, Samfya District, Zambia^{1,2}

	Energy	Protein	Fat	Carbohydrates	Calcium	Iron	Vitamin A
Infants (n=106; age: 6–9 months)							
Fish	3	19	2	0	7	12	7
Meat and dairy	1	3	1	0	1	3	2
Cereals	12	11	3	19	2	25	1
Roots and tubers	9	2	0	17	7	26	2
Vegetables and fruits	1	1	0	2	4	5	6
Legumes and nuts	3	6	6	1	1	6	0
Other foods ³	4	2	3	5	1	4	0
Breast milk	66	56	84	56	76	20	82
Toddlers (n=99; age: 14–20 months)							
Fish	6	33	6	0	15	16	14
Meat and dairy	1	5	2	0	2	3	2
Cereals	21	17	7	32	5	31	2
Roots and tubers	13	3	1	22	12	23	3
Vegetables and fruits	3	3	0	4	11	10	17
Legumes and nuts	5	7	11	1	2	6	1
Other foods ³	5	3	5	6	3	5	1
Breast milk	47	29	67	34	51	7	61

Note (1) Data collected by 24-hour dietary recall, as reported by mothers. (2) Data presented are percentage contribution of different food groups and breast milk to energy and nutrient intakes. (3) Examples of other foods include water, sugar, oil, lemonade and biscuits. (4) Breast milk intake and energy and nutrient contribution from breast milk were estimated.

Source Hautvast and van der Heijden (1999).

foods promote the bioavailability of micronutrients from other foods in the meal (Aung-Thau-Batu, Thein-Thau and Thau-Toe 1976).

4 Fish consumption in the first 1,000 days of life

In Zambia, as in other countries, very little data on intra-household food consumption or consumption of fish by pregnant and lactating women and young children are available. A baseline survey conducted under the Realigning Agriculture to Improve Nutrition (RAIN) project in Mumbwa District, Central Province, collected data on food intake by mothers or caregivers (n = 2,136; 17–44 years of age) of young children in June–August 2011 (Harris, Quabili and Rawat 2012). Many more women had eaten fish than other animal-source foods in the 24 hours preceding the survey; whereas about half of the women (47 per cent) had eaten fish, only one-fifth had eaten meat and milk products, and about one-tenth had eaten eggs. In the above-mentioned survey, data were also collected on the initiation of complementary feeding in children (n = 3,036; 24–59 months of age) (see Table 3). Before six months of age, 17 per cent of children had been fed fish, and more children were fed small fish than large fish. At six months of age, by far the largest proportion of children was introduced to fish in their diet compared to other animal-source foods. In a survey conducted in four districts adjoining the Barotse Floodplain,⁶ Western Province, it was reported that 51.4 per cent of children (n = 284, age:

1–23 months) were introduced to fish in their diet at six months of age, and 36.6 per cent at 7–9 months of age.⁷ Six per cent of children ate fish at 3–5 months of age (Longley pers. comm. 2013, based on unpublished data).

In a study conducted in Samfya District, Luapula Province, data on food intake of two groups of young children (n = 106, age: 6–9 months; n = 99, age: 14–20 months) were collected from mothers using a 24-hour recall method (Hautvast and van der Heijden 1999). Energy and nutrient contribution from breast milk and different food groups are presented in Table 4. Breast milk contributed the largest proportions of energy and nutrients in both age groups compared to the other food groups. Fish, in both groups of children, contributed considerable proportions of protein, iron and calcium. In comparison to the other animal-source food, meat and dairy, fish contributed a larger proportion of protein and minerals.

Data presented from the above three areas of Zambia represent different agro-ecological conditions and population groups. Parts of Mumbwa District are about 10–15km from the Kafue Flats wetlands; a large part of Samfya District is adjacent to Lake Bangweulu and the sites sampled in Western Province were either on or very close to the Barotse Floodplain. In Mumbwa District, the majority of sampled households relied on farming for their income, and in areas in and around the floodplain and in

Samfya District the main source of livelihood for the majority of the sample was farming and/or fishing.

Even though the above data are for specific geographical locations, with different availability of and access to fresh fish and dried small fish, and given seasonal differences in the time of data collection, it is clear that dried small fish forms an important part of the diet of women and young children. The data suggest fish is the most common animal-source food in the diet, and dietary patterns suggest that there is a potential to increase the quantity and frequency of fish consumption in the first 1,000 days of life in order that fish can make a greater contribution to the requirements of essential nutrients in this crucial period of the child's growth and development.

5 Efforts to promote the use of fish in complementary foods for young children and in the diets of women

It is well recognised that sufficient intakes of energy and nutrients in pregnant and lactating women and young children are essential for growth and development of the child. However, it is also well known that the nutritional status of women, at all stages of growth and development before pregnancy, is essential for optimal birth outcomes. There is a special need for essential fatty acids such as EPA and DHA for brain development and cognition in the first 1,000 days of life, and there is much focus on the amounts of essential fats in the diet of the pregnant and lactating women as well as in complementary foods (Innis 2007; Michaelsen *et al.* 2011). In this respect, the role of fish as a rich source of essential fats is highlighted (Beveridge *et al.* 2013). However, data on the fatty acid composition of fish species, especially the commonly consumed small fish species in Zambia, are lacking.

Efforts to increase the intake of fish in the diets of pregnant and lactating women have recently been initiated in Bangladesh, where small fish is a common food in the traditional diet. A fish chutney made of dried small fish, onion, garlic, chili and mustard oil has recently been developed and will be tested in 2014 (Jessica Bogard, pers. comm. 2013). More work has been done on including nutrient-rich foods in complementary foods for young children in Bangladesh (Kuyper, Vitta and Dewey 2013). In Zambia, a dried *kapenta*-based complementary food was formulated and tested in the 1990s by the National Institute for Strategic Industrial Research (Augustine Kaunda, pers. comm. 2013). It was reported that mothers did not like the fishy odour of the product, which may have been due to the processing methods used. The use of dried fish powder in homemade porridges for children has been promoted in Zambia for at least six years (NFNC 2007). More recently, in Eastern and Central Zambia, the International Potato Center developed a number of complementary food recipes with vitamin A-rich orange sweet potato, dried fish and beans (Emily Mueller, pers. comm. 2013).

As part of the WINFOOD project, which seeks to alleviate childhood malnutrition in developing countries through improved utilisation and processing of traditional foods, two complementary foods including dried small fish were developed. In Kenya a complementary food composed of dried *kapenta*, maize flour, amaranth seed and termites was

developed, and the acceptability tested (Konyole *et al.* 2012); and in Cambodia, a complementary food including two dried small fish species, one rich in iron and zinc and the other rich in essential fats, rice flour and edible spider, was developed and the effect on growth in children aged 6–15 months was tested (Skau *et al.* 2014). The Kenyan complementary food was found to be acceptable and was recommended for further development. Use of the Cambodian complementary food was found to improve nutrient adequacy, though the impacts on growth have not yet been reported. In Bangladesh, a complementary food, made with rice flour, a dried small fish species that is rich in iron and zinc, vitamin A-rich orange sweet potato flour and oil, is being developed and its acceptability to children aged 6–23 months will be tested in 2014 (Jessica Bogard, pers. comm. 2013). These examples suggest that there is potential to develop acceptable and nutritious fish-based complementary foods in Zambia.

5.1 The need to increase fish supplies in Zambia

Given the cultural, economic and dietary importance of fish, the declining per capita availability, together with the natural limits to expanding production from capture fisheries, there is an urgent need to manage sustainably Zambia's wetland resources to prevent a decline in productivity. There seems to be an unmet demand for fish as multinational aquaculture companies, recently established in Lake Kariba, have begun prioritising domestic markets. With stagnating supply from capture fisheries and a growing population, aquaculture is seen as an increasingly important means of boosting production and consumption of fish in Zambia. However, the expansion of aquaculture has been slow, contributing to 13 per cent of the total fish supply in 2011 (see Table 1). Aquaculture targets the sale of fish to the middle-income population group, and large breams (250–500g fish) are farmed by the larger-scale commercial operations which account for an increasing proportion of production.

Production of fish in the numerous smallholder ponds, which is being promoted by government and non-governmental organisations (NGOs), contributes an unknown but potentially significant amount to household fish intake, even while it contributes little to national fish supplies. No research has yet been done on farming specific fish species to meet the needs for essential fats and micronutrients in the first 1,000 days. In Bangladesh, smallholder pond polyculture technologies based on carps and micronutrient-rich small fish from the surrounding wetlands were developed and are presently being scaled out throughout the country. Similar technologies were also adopted in Cambodia, Terai in Nepal and Sunderbans in West Bengal (Thilsted 2012b). However, much more work is needed on species selection, breeding and management, including development of feeds that maximise the nutrient content of farmed small fish eaten whole (Beveridge *et al.* 2013).

6 Summary and recommendations for the First 1000 Most Critical Days Programme

Fish – particularly small fish – are clearly important in providing essential nutrients in the first 1,000 days of life in Zambia, yet there are limited data currently available that provide detailed evidence of the types and quantities

of fish that are eaten by pregnant and lactating women and young children. It is thought that both the quantity and frequency of fish consumption can be increased to both enhance essential fatty acid and micronutrient intake and fulfil a greater proportion of nutrient needs in the first 1,000 days.

There is a need to increase the supply of fish in Zambia, both by the sustainable management of capture (wild) fishery resources and by promoting aquaculture. In order to select the fish species for aquaculture production, we must first know the nutrient composition of many fish species, and use this information to select fish species that can be sustainably cultured to increase productivity and production, as well as to produce fish of high nutrition quality. Fish supplies in Zambia are, however, seasonal (Musumali *et al.* 2009). An annual closed fishing season (November–March) was enforced some eight years ago, with the result that for several months of the year only preserved (dried, salted, smoked, frozen), farmed and imported fish are available to consumers.

From a policy and marketing perspective, it is important that small fish are promoted not as a cheap or affordable animal-source food (which may reinforce apparent attitudes that they are somehow inferior to other animal-source foods), but as an important source of nutrients necessary for healthy growth. In this respect, behaviour change communication and nutrition education of all household members – both females and males of all ages – are needed to ensure that there is common understanding of the importance of fish in enhancing child growth and development, brain development and cognition, and school and work performance later in life. Innovative measures for this knowledge to be translated into action need to be developed.

Notes

- * The authors wish to recognise the collective knowledge and insightful perspectives of our many Zambian partners on this article. We also wish to thank Jocelyn Runnebaum, formerly of Peace Corps, Zambia, for her compilations of fisheries data and draft texts on *kapenta* and *chisense* fisheries, while seconded to WorldFish. This initial review of literature was financed by the OPEC Fund for International Development. We also acknowledge the financial support of the CGIAR Research Program on Aquatic Agriculture Systems in gathering the consumption data cited for Western Province, and the work of Kusiyo Mbikusita Lewanika in analysing these data. The present article contributes to the CGIAR Research Programs on Aquatic Agricultural Systems and Agriculture for Nutrition and Health.
- 1 Capture fisheries refer to the wild fisheries that exist in lakes, rivers and reservoirs. Farmed fisheries provide a very small source of fish in Zambia, through either pond or cage aquaculture.
 - 2 The first 1,000 days of life covers nine months of pregnancy, the first six months of the life of the child when exclusive breastfeeding is recommended, and

There are already various examples of fish-based recipes for homemade complementary foods in Zambia, and there is potential to develop and promote these recipes further. Following recent work in Bangladesh, there is also the potential to develop locally appropriate fish-based recipes to enhance the nutrient intake of pregnant and lactating women. Not all fish have the same nutrient profile, and there is a need for further research to determine which fish species are the most appropriate to maximise the nutrient content of both complementary foods for young children and potential supplementary foods for pregnant and lactating women. We also need to better understand preferences, cultural beliefs, and preparation methods regarding consumption of specific species and promote beneficial practices. The effects of post-harvest processing, transport, storage and cooking methods on the contribution of nutrients from fish in Zambia are currently not known.

There is the opportunity to develop not only recipes for homemade fish-based complementary foods that are made from locally available ingredients but possibly also manufactured fish-based complementary food products. The advantage of the latter is that it overcomes the seasonal constraints in the availability of fish. Whether homemade or manufactured, if such products are to be used in the first 1,000 days, they must be well liked (i.e. have good taste, colour, texture and aroma), the ingredients must be physically and economically accessible, and the dish must be relatively quick and easy to prepare.⁸ In addition to complementary foods for young children, there is also potential to develop fish-based foods suitable for pregnant and lactating women. Following the example of Bangladesh, the preparation and marketing of such foods can also provide an opportunity for income generation and thus contribute to women's empowerment.

thereafter, up to the child's second birthday where continued breastfeeding and complementary feeding are recommended (see Harris *et al.*, this *IDS Special Collection*).

- 3 The term 'bioavailability' is defined as the proportion of an ingested nutrient in food that is absorbed and utilised through normal metabolic pathways. It is influenced by both host- and diet-related factors.
- 4 These per capita fish supply statistics do not imply that every person in Zambia consumes this quantity of fish; both national and household fish supplies are highly unequally distributed.
- 5 Aquaculture or fish farming in Zambia includes the production of fish in floating cages on the larger lakes, as well as farming fish in purpose-built ponds.
- 6 The four districts are Mongu, Senanga, Kalabo and Lukulu.
- 7 These data are based on recall by mothers for the age at which their youngest child started to eat fish.
- 8 It has been well documented that Zambian mothers have limited time available to prepare nutritious food for their babies (Harris *et al.* 2012; Kent and MacRae 2010; Vaughan and Moore 1988).

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The Impact of an Unconditional Cash Transfer on Food Security and Nutrition: The Zambia Child Grant Programme

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Abstract The Child Grant Programme is one of the Government of Zambia's largest social protection programmes. The programme provides a monthly cash payment of 60 kwacha (US\$12) to very poor households with children under five years old. A randomised controlled trial of 2,515 households was implemented to investigate the impact of the programme. We find that cash transfers improve household consumption, food consumption, diet diversity and food security. These outcomes lie along the causal pathway linking the cash transfer to children's nutrition. For children under five, we observe positive but not statistically significant impacts of the programme on weight. We find strong and significant heterogeneous impacts on reducing stunting among children who have access to clean water or more educated mothers. The results demonstrate that nutrition can be improved through an integrated and holistic strategy instead of only pursuing targeted programmes in one sector such as health or agriculture.

1 Introduction

A person's life-chances are shaped at a very early age. Early childhood nutrition and nutritional status as early as age two, has been linked to later life outcomes such as cognitive capacity (Paxson and Case 2008), school attainment (Alderman *et al.* 2001) and adult earnings (Strauss and Thomas 1998), and more than half of infant and child mortality is due to underlying malnutrition (WHO 2005). At the aggregate population level, the consequences of early childhood malnutrition can be dire, with one study estimating a potential loss of 3 per cent of GDP in India due to undernutrition (World Bank 2006) alone. With such large stakes, the key question is what policy instruments are available to governments to prevent early childhood malnutrition. This article presents results from one such possible instrument, the Zambia Child Grant Programme (CGP). The CGP started in 2010 and provides small, predictable sums of cash to families with children under age five in the poorest districts in the country. Though the CGP is not exclusively a nutrition programme, it aims to address poverty, food security, access to public services and productivity, all of which are themselves determinants of childhood malnutrition. Because the programme explicitly targets households with young children, it provides an opportunity to assess the impact of a 'structural' approach to preventing or reducing early childhood malnutrition, which, because it addresses the underlying drivers of malnutrition, may be more cost-effective than narrow sector-specific programmes.

The success of cash transfer programmes in improving childhood nutrition has recently been reviewed by Manley, Gitter and Slavchevska (2011). They find that in 17 studies covering 16 cash transfer programmes there is no consistent relationship between programme participation and child nutritional status. They also find that

unconditional programmes seem to do better than conditional programmes, especially when the conditional programmes involve non-health related conditions. Their data sources included two published studies based on African programmes, the Malawi Social Cash Transfer (SCT) Programme (Miller, Tsoka and Reichert 2009) and the South African Old Age Pension (Duflo 2003). Though both these programmes are unconditional, their target group is quite different from the Zambian programme. The South African programme is an old-age pension and so obviously has a very different objective than child nutrition, and so the documented impacts on young children are limited to those that live with a grandparent that is eligible for the pension. In contrast, the Malawi SCT targets 'labour constrained' households who also tend to have much fewer pre-school children than the average poor household in Malawi. In contrast, the Zambian CGP directly targets all households with a child under five in programme areas, and has a clear objective of improving the health and nutritional status of young children.

2 The Child Grant Programme

In 2010, Zambia's Ministry of Community Development, Mother and Child Health (MCDMCH) started the roll-out of the CGP in three districts with the highest rates of child mortality and poverty: Kaputa, located in Northern Province, and Shongombo and Kalabo, both located in Western Province. All three districts are near the Zambian border with either the Democratic Republic of Congo (Kaputa) or Angola (Shongombo and Kalabo). Because Shongombo and Kalabo are cut off from Lusaka by a floodplain that turns into a river in the rainy season, they can be reached only by boat during some months of the year. These districts represent some of the most remote locations in Zambia, making them a challenge for providing social services, and are some of the most

Table 1 Baseline comparisons for households and recipients

Variables	Control		Treatment		Mean difference	p-value
	Mean	N	Mean	N		
Expenditures on food per capita (ZMK)	29.27	1259	30.79	1260	-1.52	0.49
Total household expenditure per capita (ZMK)	39.48	1259	41.38	1260	-1.90	0.47
Severely food insecure (%)	0.90	1246	0.90	1250	0.00	0.97
More than one meal per day (%)	0.78	1255	0.79	1253	-0.01	0.74
Household size	5.63	1259	5.76	1260	-0.12	0.47
Female recipient (%)	0.99	1257	0.99	1255	0.01	0.18
Recipient's highest grade completed (Grades 1–12)	3.79	1253	4.31	1247	-0.52	0.08
Married recipient (%)	0.71	1255	0.74	1251	-0.02	0.58

Source Authors' own.

underprivileged communities in Zambia. The CGP is a categorically targeted programme – any household within the district with a child under five years old is eligible. Recipient households receive 60 kwacha (ZMW) a month (equivalent to US\$12) irrespective of household size, an amount deemed sufficient by the MCDMCH to purchase one meal a day for everyone in the household for one month. The goal of the CGP is to reduce extreme poverty and the intergenerational transfer of poverty through five primary areas: income, education, health, food security and livelihoods. Payments are made every other month through a local paypoint manager, and there are no conditions to receive the money. In the initial phase of the programme, only households with children under age three were enrolled to ensure that every recipient household would receive the transfers for at least two years.

3 Study design

The CGP impact evaluation randomised communities into treatment and control groups to estimate the effects of the programme on recipients. Ninety communities designated by Community Welfare Assistance Committees (CWACs) were randomly selected (out of 300) to be in the study

sample. These 90 CWACs were then randomly assigned to either the treatment condition (45 CWACs) to start the programme in December 2010 or to the control condition (45 CWACs). Randomisation occurred within each of the three study districts. Baseline data was collected in October 2010 prior to households in the treatment arm entering the programme; a 24-month follow-up survey was conducted in October 2012. The timing of the survey rounds occurred during Zambia's lean season, when people have the least amount of food left from the previous harvest and hunger is at its greatest, and also to avoid the rainy season for best accessibility to households. Crops are planted in the rainy season, from December to April, and harvested throughout the rainy season and into May. Food is most scarce towards the end of the hot dry season (October and November) because this is the longest period without a food harvest.

4 Study sample and baseline equivalence

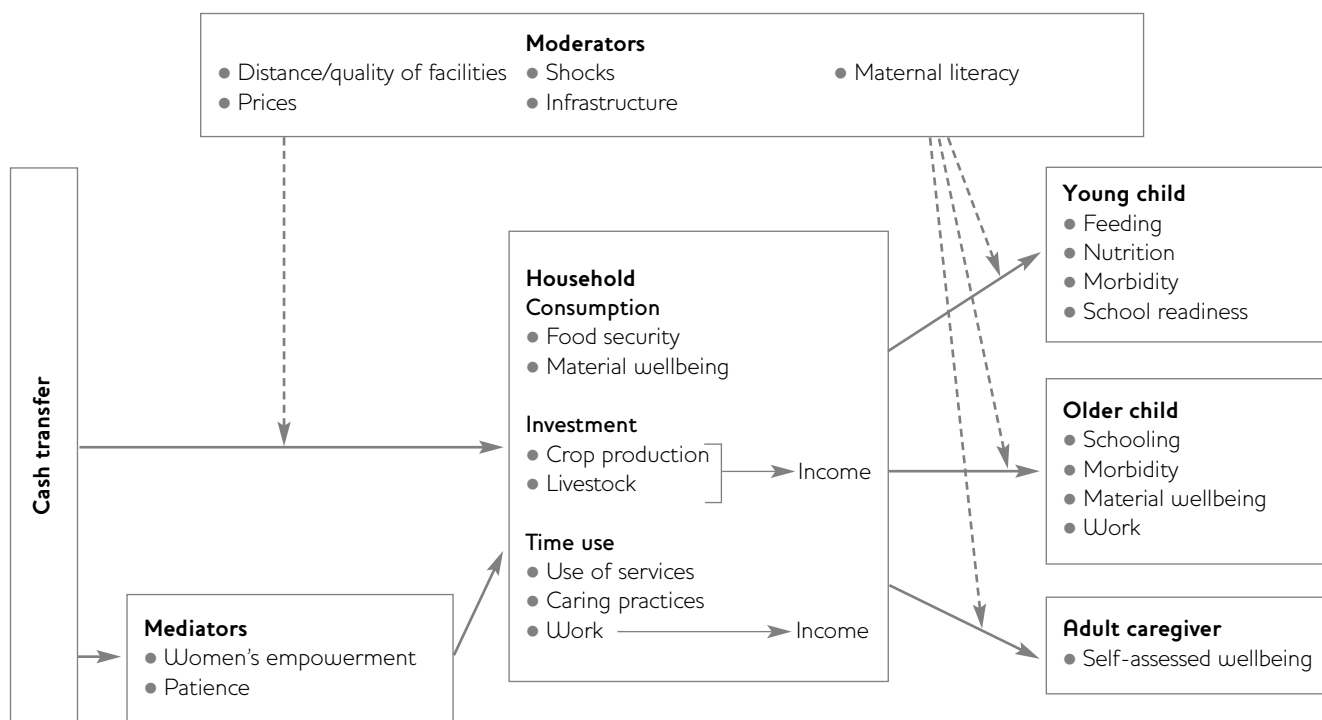
The evaluation study contains a sample of 2,514 households, with 14,565 people, almost all of whom live below the extreme poverty line (95 per cent). Almost one-third (4,793) of the sampled individuals are children under

Table 2 Baseline comparisons for children under five years old

Variables	Control	N (control)	Treatment	N (treatment)	Mean difference	p-value
Children ages 0–5 per household	1.92	1259	1.88	1260	0.04	0.47
Children ages 0–1 per household	0.75	1259	0.77	1260	-0.02	0.30
Children ages 1–2 per household	0.77	1259	0.79	1260	-0.02	0.38
Children ages 2–3 per household	0.69	1259	0.67	1260	0.02	0.54
Children ages 3–4 per household	0.54	1259	0.51	1260	0.03	0.37
Children ages 4–5 per household	0.49	1259	0.44	1260	0.04	0.15
Female (%)	0.50	2113	0.52	2102	-0.02	0.17
Stunted (%)	0.36	1770	0.34	1709	0.02	0.42
Wasted (%)	0.06	1767	0.06	1703	0.00	0.85
Underweight (%)	0.16	1991	0.17	1955	-0.01	0.62

Source Authors' own.

Figure 1 Conceptual framework for impact evaluation of child grant programme



Source Zambia CGP Baseline Report.

age five, with the largest number under one year old (1,427), making the study unique for cash transfer evaluations in Africa – the sample has the largest proportion of children in this age range. This very young study sample is also exciting given the increased recognition of the importance of the first 1,000 days of life for a child's future development. Among the recipients, 99 per cent are female and among children under five years old, half are female.

Increased nutrition and food security, especially for young children, are two primary goals of the CGP. At baseline, the average household spent 30.10 kwacha (roughly US\$6) per person per month on food, which represents roughly 72 per cent of its total per capita expenditures. Thus, beneficiaries spent most of their money on food. The biggest portion of money spent on food was for cereals at 33 per cent, which includes the staple food, maize, and 49 per cent was spent on carbohydrates as a whole when we also account for roots and tubers. Fruits and vegetables signify the second biggest category, with 22 per cent of overall food spending in this category. Proteins and fats are small relative to carbohydrates, explaining why we see malnourished children in the sample. Many households are food insecure with over 20 per cent only eating one meal per day.

Our comparison of control and treatment groups at baseline finds that randomisation created equivalent groups for the CGP evaluation. Table 1 shows the balance for households and recipient level indicators, while Table 2 shows the balance for children under five nutrition indicators.

Ninety-one per cent of the households from baseline remain in the 24-month follow-up sample. We investigate

attrition at the 24-month follow-up by testing for similarities at baseline between (1) treatment and control groups for all non-missing households (differential attrition) and (2) all households at baseline and the remaining households at the 24-month follow-up (overall attrition). Testing these groups on baseline characteristics can assess whether the benefits of randomisation are preserved at follow-up. Fortunately, we do not find any significant differential attrition at the 24-month follow-up, meaning that we preserve the benefits of randomisation. We find small differences between the study population at baseline and those that remain at the 24-month follow-up; the remaining households are less likely to have experienced a shock, especially flooding or drought at baseline, and they consume a higher proportion of maize over cassava. The remaining sample at 24-month follow-up is likely more similar to populations throughout Zambia because most of the missing households from the study depend on a lake that is drying up for their livelihood, a characteristic less common throughout the country. The study's generalisability (external validity) likely has increased with the study population at the 24-month follow-up because the remaining sample is more similar to the general rural population in Zambia where the programme might be scaled.

5 Empirical approach and hypotheses

This study reports on the effects of the programme for nutrition outcomes after two years of programme implementation. We estimate programme impacts on individuals and households using a difference-in-differences (DD) statistical model that compares change in outcomes between baseline and follow-up and between treatment and control groups. The DD estimator is the most commonly used estimation technique for impacts of

Table 3 Impact of CGP on per capita total and food expenditure

	Programme impact	Baseline mean	24-month treatment	24-month control
Total	15.18 (5.07)	46.56	6704	48.59
Food	11.60 (4.76)	34.45	50.16	35.85
Cereals	4.54 (3.26)	11.61	15.54	9.95
Tubers	-0.924 (-1.25)	4.96	4.56	4.93
Pulses	1.22 (4.98)	0.94	2.00	0.77
Meats	2.44 (3.08)	6.78	11.43	7.91
Fruits, vegetables	0.49 (0.56)	7.03	8.86	8.89
Dairy	0.76 (3.55)	0.88	1.27	0.48
Baby foods	0.02 (0.78)	0.01	0.03	0.01
Sugars	1.28 (7.80)	0.79	2.61	0.98
Fats, oil, other	1.76 (6.13)	1.45	3.87	1.93
N	4,594			

Note Estimates in column 1 are based difference-in-differences modelling among panel households. Robust t-statistics clustered at the CWAC level are in parentheses. Bold indicates that they are significant at $p < .05$. All estimations control for household size, recipient age, education and marital status, districts, household demographic composition and a vector of cluster-level prices. Source Zambia CGP 24 Month Report.

cash transfer models and has been used, for example, in Mexico’s Progreso Programme¹ and Kenya’s Cash Transfer for Orphans and Vulnerable Children (Kenya CT-OVC Evaluation Team 2012). We use cluster-robust standard errors to account for the lack of independence across observations due to clustering of households within CWACs.² We also use inverse probability weights to account for the 9 per cent attrition in the follow-up sample (Woolridge 2010).

We briefly sketch out the pathways for the intervention to lead to desired outcomes, including nutrition. The CGP provides an unconditional cash transfer to households with a child under age five. CGP-eligible households are extremely poor, with 95 per cent falling below the national extreme poverty line and having a median household per-capita daily consumption of ZMW1.05, or approximately 20 US cents. Among households at such low levels of consumption, the marginal propensity to consume will be almost 100 per cent; that is, they will spend all of any additional income rather than save it. Thus, we expect the immediate impact of the programme will be to raise spending levels, particularly basic spending needs for food, clothing and shelter, some of which will influence children’s health and nutrition. The next step in the causal chain is the effect on children. It is important to recognise that any potential impact of the programme on

children, including their nutritional status, must work through the household by its effect on spending or time allocation decisions (including use of services). The link between the household and children can be moderated by household-level characteristics themselves, such as the mother’s education or access to clean water. The impact of the cash transfer may be weaker or stronger depending on these conditions; thus, we analyse heterogeneous treatment effects on children by these moderating conditions. Figure 1 shows the pathways for how the intervention might lead to nutritional impacts, as well as other desired outcomes of the programme. The diagram demonstrates the complexity of evaluating a cash transfer programme due to the myriad of potential pathways and impacts to investigate.

6 Results

We investigate the impact of the CGP on three sets of outcomes related to nutrition: household food consumption, household food security, and anthropometric measures for children under five years old. As discussed in the theoretical framework, we consider food consumption and food security to be first round outcomes because they are directly related to how the beneficiary households choose to spend their cash transfer (i.e. the amount of the transfer spent on food). Children’s anthropometry is a second-round outcome because it requires several

Table 4 Impact of CGP on food security

	Programme impact	Baseline	24-month treatment	24-month control
Eats more than one meal a day	0.079 (4.02)	0.78	0.97	0.89
Food security scale	2.498 (4.23)	15.10	9.63	12.36
Is not severely food insecure	0.177 (4.00)	0.10	0.36	0.16
N	4,549	2,249	1,153	1,145

Note Estimates in column 1 use difference-in-differences modelling among panel households. Cluster-robust t-statistics are in parentheses. Bold indicates that they are significant at $p < .05$. All estimations control for household size, recipient age, education and marital status, districts, and a vector of cluster-level prices. All estimates are corrected for attrition bias.

Source Zambia CGP 24 Month Report.

behavioural responses in addition to spending the transfer to induce impacts on these outcomes. We start by presenting the results for the first round effects and then move to second-round effects on children.

Table 3 shows the impacts of the programme on food consumption by category. We find that the CGP increases consumption per capita by 15.18 kwacha per month. Increased consumption is the first step along the causal chain to improved nutritional outcomes, but only if the money is spent on nutrition-related items. The majority of the increased consumption goes to food (ZMW11.60), which is 76 per cent of additional consumption. Within food consumption, the largest share goes to cereals (ZMW4.54), followed by meats, including poultry and fish (ZMW2.44), followed by fats such as cooking oil (ZMW1.76) and then sugars (ZMW1.28). There is a clear shift away from roots and tubers (primarily cassava) and towards protein (dairy, meats), indicating an improvement in diet diversity among CGP recipients.

Table 4 shows the impact of the programme on food security. The CGP improves beneficiaries' food security in addition to their consumption of food. This result means that the programme enables many households to regularly purchase a sufficient amount of food that lifts them out of their severely food insecure status. The programme increases the number of households eating more than one meal a day by eight percentage points and increases the number of households not severely food insecure by 18 percentage points to 97 per cent, nearly all. The control group improved over the two-year period, reflecting the bumper harvests of 2010 and 2011 that affected many people throughout Zambia. However, the programme improved food consumption and food security after accounting for the bumper harvest, bringing greater nutritional gains to poor households with children under five.

The CGP targets households with children under five years old, so we investigate nutritional outcomes such as stunting, wasting, and underweight and their anthropometric measures (height-for-age, weight-for-age and weight-for-height) for those children. Most of these outcomes are second-round effects in that they are not affected directly by the cash transfer but require a series of behavioural responses by the household induced by the

income effect of the cash transfer in order to change. For example, nutritional status is affected by caregiving behaviours, caloric intake and sanitation. For the CGP to affect nutritional status, it must induce a change in feeding practices or the disease environment of the household. Table 5 shows results of the impact of the CGP on the nutritional status of children under five years old. We do not find any nutrition impacts for the full sample of children under five, although we do find programmatic impacts on sub-groups of the population, specifically those with access to clean water or more educated mothers. Although we do not find impacts in the full sample, the point estimates are moving in the right direction. The impact on weight, a shorter term indicator, is larger than for height; for example, the impact on weight-for-age is 0.13 standard deviations with a *t*-statistic of 1.89, while the impact on weight-for-height is 0.12 ($t = 1.74$), both significant at 10 but not 5 per cent. We also estimated impacts for younger age groups (0–2 and 0–3), but did not find statistically significant effects among these sub-groups.

There are several reasons why we do not observe impacts on child nutrition when looking at the sample for all children under five years old even though food consumption increases. Some possible reasons are that indicators require more time to change, children are not eating sufficiently diverse diets, or external factors such as contaminated water sources that can cause diarrhoea are negatively impacting nutrition and counteracting the positive effects of the programme. Indeed, it may be that children with mothers who are more knowledgeable about nutrition or children with access to clean water benefit more from the programme than other children. The level of schooling among the programme's recipients is low; 28 per cent did not attend school and only 10 per cent attended school past grade eight. Similarly, almost a quarter of the children in the sample (22 per cent) do not have access to clean water from a protected water source (bore hole or well).

We investigate heterogeneous impacts by mother's education and access to clean water since these factors are linked to nutritional outcomes for children. Table 5 shows the results of the heterogeneous impact estimates in columns (5) and (6). We find that the programme decreases stunting and increases children's height-for-age

Table 5 Impacts of the CGP on nutritional status of children 0–60 months old

	Programme impact	Baseline mean	24-month treatment	24-month control	Mother's education interaction ¹	Access to clean water interaction ¹
	(1)	(2)	(3)	(4)	(5)	(6)
Weight-for-age z-score (N=6825)	0.128 (1.89)	-0.902	-0.900	-0.963	0.012 (1.17)	0.149 (1.86)
Weight-for-height z-score (N=6157)	0.118 (1.74)	-0.180	-0.0961	-0.154	0.003 (0.29)	0.003 (0.03)
Height-for-age z-score (N=6155)	0.066 (0.70)	-1.416	-1.445	-1.491	0.028 (2.05)	0.317 (2.26)
Stunting (N=6155)	-0.002 (-0.20)	0.348	0.329	0.359	-0.012 (-2.39)	-0.092 (-2.36)
Wasting (N=6157)	-0.017 (-0.66)	0.061	0.040	0.046	-0.001 (-0.52)	-0.003 (-0.13)
Underweight (N=6825)	-0.026 (-1.48)	0.162	0.159	0.168	-0.003 (-0.95)	-0.029 (-1.21)

Note Nutritional indicators are reported for children 0–60 months. Estimations use difference-in-differences modelling among panel households. Cluster-robust *t*-statistics are in parentheses. Bold indicates that they are significant at $p < .05$. All estimations control for household size, recipient age, education and marital status, districts, and a vector of cluster-level prices and are corrected for attrition bias.

¹ This column shows the coefficient for the interaction between the difference-in-differences programme impact and the indicator at the top of the column. These coefficients measure how the programme impact differs for this group.

Source Authors' own.

for children of more educated mothers and for those that have access to clean water. The programme reduces stunting by nine percentage points for children in the programme who have access to clean water compared to children in the programme without access to clean water, and reduces stunting by 1.2 percentage points for each additional year of education that their mother has. For example, the programme reduces stunting by six percentage points more for children in the programme whose mother has completed five years of school than for children in the programme whose mother has not completed any school. Roughly 28 per cent of the mothers in beneficiary households have zero years of education completed, while 46.5 per cent of mothers in beneficiary households have at least five years of education; thus, on average the programme impact on stunting among children of these more educated mothers is at least six percentage points higher than children in beneficiary households with mothers who have zero years of completed education (an effect size of 35 per cent over the combined baseline proportion).

7 Discussion and conclusion

This study investigates the impact on nutritional outcomes of receiving cash through an SCT. The successfully implemented randomised evaluation design without attrition bias provides strong internal validity to the results and enables us to attribute observed impacts to the programme. We find that cash transfers improve overall household consumption, food consumption, diet diversity and self-reported food security. We also find strong impacts on reducing the incidence of diarrhoea (4.9 percentage points) for children under five years old, but none for other young child health outcomes. These

outcomes all lie along the causal pathway linking the cash transfer to children's nutritional status. In terms of actual nutritional status, we observe positive but not statistically significant impacts of the programme when looking at all children under five years old; the effects on weight are larger than for height, and are significant at 10 per cent, suggesting that impacts will be realised as time passes. Interestingly, we do find strong heterogeneous impacts of the programme on height; the programme leads to a significant improvement in height-for-age and a reduction in stunting among children who have access to clean water or more educated mothers. These effects are quite large. For example, living in a treatment household with access to clean water leads to a nine percentage point reduction in stunting (26 per cent over the combined baseline proportion) compared to children receiving the cash only. Similarly, having a mother with complete primary schooling raises the impact of the cash transfer on stunting by six percentage points versus having a mother in the programme with no education (an effect size of 17 per cent over the baseline proportion). The cash thus appears to be an important complement to these other health inputs in improving child height. They also point towards ways that the programme can be leveraged to maximise impacts on children's nutritional status, for example by providing complementary services and/or information for beneficiaries with low levels of education. Clean water is obviously an important direct input into child nutrition; the results here indicate that the benefits of the cash are even larger when there is access to clean water at the household level.

Beyond implications for complementary services, the results in this article raise some broader issues about social policy

in the country. Zambia has experienced economic growth rates averaging 5–6 per cent annually for the past five years, but this growth has not translated into a corresponding decrease in poverty. While poverty has marginally reduced from 64 per cent in 2006 to 62 per cent in 2010 the absolute numbers of people experiencing poverty have gone up. The results from the CGP give an opportunity for the government to consider repositioning its various social protection programmes to ensure that they deliver or facilitate improved nutritional needs of children. The CGP strives to break the transfer of intergenerational poverty through affecting both protective and productive outcomes including, but not limited to nutrition. Indeed, beyond consumption and food security, results from the CGP evaluation study demonstrate very strong impacts on agricultural production and economic activity in general (AIR 2013). For example, the CGP increases the amount of agricultural land operated by 18 percentage points (a 34 per cent increase from baseline), as well as the use of

agricultural inputs. The CGP has a positive impact on the ownership of a wide variety of animals, both in terms of share of households with livestock (a 21 percentage point increase overall, from 49 per cent at baseline), as well as the number of animals owned in the case of ducks, chickens and goats. Further, beneficiary households experience approximately double the volume of purchase and sales of livestock compared with control households. These effects are likely to further benefit young children in the medium and long term. Taken together, the results demonstrate that nutrition can be improved through an integrated and holistic strategy instead of only pursuing targeted programmes in one sector such as health or agriculture. The wide range of impacts across different development domains make unconditional cash transfers such as the CGP a promising way to achieve poverty alleviation, economic growth and child human capital development, and should therefore be an important part of the development policy dialogue in countries like Zambia.

Notes

- 1 <http://wbro.oxfordjournals.org/cgi/reprint/20/1/29>
- 2 www2.sas.com/proceedings/sugi23/Posters/p205.pdf

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Cash or Food? Which Works Better to Improve Nutrition Status and Treatment Adherence for HIV Patients Starting Antiretroviral Therapy

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Abstract The overall objective of this DFID-funded study was to understand whether cash or food transfers were more effective for HIV-positive individuals starting antiretroviral therapy (ART) in improving nutrition, health status and adherence to ART. HIV-positive individuals initiating ART at the St Francis Mission Hospital in Katete District, Eastern Province, were randomly allocated to two treatment groups (cash and food), and given a food basket or its cash equivalent monthly, for eight months. Both treatment groups saw significant increases (p -value <0.001) in Body Mass Index (BMI), Household Dietary Diversity Score, good adherence to ART, and in mean CD4 count, but there were no significant differences between the two treatment groups in these measures. The study concluded that the provision of cash or food for eight months when clients start ART confers similar and significantly positive effects in improving clients' nutrition and health. Providing cash is likely to be more cost-effective.

1 Introduction

According to UNAIDS, new HIV infections fell by 33 per cent between 2001 and 2012, from 3.4 to 2.3 million globally, but 70 per cent of new infections occur in sub-Saharan Africa (UNAIDS 2013). At regional level, Zambia was among the countries with the smallest prevalence drop between 2001 and 2007 (Government of Zambia 2010). State provision of antiretroviral therapy (ART) in Zambia began for a few people in Lusaka in 2002 and by the beginning of 2004 the Ministry of Health offered ART for free in a wide range of health facilities. The programme expanded rapidly with over 400,000 people now receiving ART across the country. With high levels of coverage of ART achieved in recent years, attention has also started to be paid to related concerns, including nutrition.

Adequate dietary intake and absorption are essential for achieving the full benefits of ART, and there is emerging evidence that patients who begin therapy without adequate nutrition have lower survival rates (Paton *et al.* 2006). ART itself may increase appetite and it is possible to reduce some side-effects and promote adherence if some of the medicines are taken with food. Food insecurity and poor nutrition can also hasten the progression of AIDS-related illnesses, while the virus itself reduces the capacity of people living with HIV to work to provide food for themselves and their families. Given the need for adherence in delaying resistance to first-line drugs, nutritional support is increasingly seen as critical to sustaining antiretroviral treatment (World Bank 2007).

Studies have also suggested that several important factors influence adherence to ART, including forgetfulness, lack of understanding of treatment regimens or benefits, complexity of drug regimens, and depression, as well as food and nutrition insecurity (Sanjobo, Frich and Frøtheim 2008). A study carried out in Kenya and Zambia (ODI 2008) suggested that the provision of food assistance for HIV-infected adults already receiving ART may improve medication adherence, with likely greater effects at earlier stages of treatment. A matched case control study in northern Ethiopia (Berhe, Tegabu and Alemayehu 2013) also showed that an association exists between adherence and getting enough and quality food. These findings pointed to the fact that the capacity to effectively manage the food and nutrition implications of ART adherence is a critical factor in the success of ART in resource-limited settings such as Zambia.

Further, over the past decades, there has been acknowledgement of the importance of social protection to respond to a range of challenges faced by individuals and households affected by the HIV pandemic. Social protection measures have been known to reduce HIV-related vulnerability and are critical drivers for efficacious HIV prevention and treatment outcomes. Among the several social protection measures, cash or food transfers are increasingly being used as methods for improving nutrition and adherence to treatment. It is not known, however, whether the provision of cash instead of food would lead to different impacts for patients, in terms of nutrition status, adherence to ART and the welfare of the

Table 1 Nutrition status of study clients by survey points and by treatment group

Nutrition status category	Baseline				Endline			
	Cash		Food		Cash		Food	
	n	%	n	%	n	%	n	%
Severely underweight	7	4.5	4	2.6	1	0.7	2	1.5
Moderately underweight	35	22.6	29	19.1	9	6.7	16	12.2
Normal	103	66.5	106	69.7	109	80.7	95	72.5
Overweight	8	5.2	11	7.2	13	9.6	17	13.0
Obese	2	1.3	2	1.3	3	2.2	1	0.8
Total	155	100	152	100	135	100	131	100

Source Authors' own from Kawana *et al.* (2012).

household as a whole, as well as which of the two transfers is more cost-effective.

2 Study objective and methodology

The overall study aim was to fully understand which transfer mechanism (cash or food) ensures adequate nutrition improvement for those initiating ART treatment, and which increases adherence to ART in a more effective way. Specifically the study was meant to:

- Examine whether providing cash or food transfers to patients initiating ART improves their nutritional status (BMI);
- Assess whether providing cash or food transfers to patients initiating ART improves Household Dietary Diversity Score (HDDS);
- Assess which transfer type better improves adherence to ART;
- Examine whether CD4 count is improved by providing a patient initiating ART with food or cash; and
- Assess which of the two transfers (cash or food) is more cost-effective.

The study was conducted in Zambia's Eastern Province, in Katete District, at the St Francis Mission Hospital. The hospital has a 350-bed capacity and provides medical and surgical care to over 200,000 people in Katete District, as well as accepting referrals from the whole of Eastern Province. Adults, male and female, aged 18–55 years, recently diagnosed with HIV and initiated on ART, were randomly allocated to two treatment arms (cash or food), regardless of socioeconomic status. The study was restricted to only those clients who resided within Katete District boundaries.

The required sample size was determined to provide a 95 per cent confidence and with a 90 per cent power, and a 30 per cent effect on adherence, based on similar studies (Tirivayi, Koethe and Groot 2010; Bangsberg 2011). This estimated effect on adherence of 30 per cent was based on the fact that the studies referred to had control groups, while the Katete ART study did not. The sample estimation was chosen as it depends on a population-estimated standard deviation, as opposed to the use of prevalence rates to estimate the sample size. This was necessary because St Francis Hospital is a referral centre attending to

patients not only from Katete or Eastern Province but also other parts of Zambia, and so estimating using prevalence rates was not feasible. The study sample was therefore estimated to be 149 participants per treatment arm, which meant that, allowing for 10 per cent non-response rates, the study aimed to enrol a total sample of 328 participants across the two treatment arms. By the end of the study, a total of 147 clients in each treatment arm remained in the study. As this sample size would have been required had we intended 94.68 per cent confidence, rather than 95 per cent, the findings can be treated as significant, despite this small reduction in final sample size.

The clients were supported unconditionally with monthly food or cash transfers, using electronic vouchers, for a period of eight months, in accordance with the World Food Programme (WFP) Zambia protocol. The monthly WFP standard food basket utilised under this study consisted of 25kg maize meal, 4kg beans, 2kg sugar, 2.5 litres vegetable oil and 1kg salt. Clients on the cash transfer received the amount which was equivalent to the value of the cost of the food basket. The value of the e-vouchers (both cash and food) was reviewed on a monthly basis through surveys of the food basket's cost in the local market. Due to fluctuations in prices of the food commodities, the value of the food basket used in this study varied between US\$20 and US\$31 during the eight months of intervention.

3 Limitations

The study had three principal limitations. Firstly, due to ethical and feasibility considerations, clients' recruitment was not made at once but over a period of four to six months, and so provision of the study intervention (transfers) did not begin at the same point in time for each and every client, which in turn meant that baseline and endline surveys were occurring for different clients at different stages of the agricultural cycle and associated hunger season. This does, however, mean that the timing of surveys in the agricultural cycle would not have had a significant effect across the whole sample. Secondly, one of the key assumptions of this study was that there was already sufficient evidence suggesting that HIV patients on ART respond well and quickly when they are provided with either a cash or food transfer (Hughes *et al.* 2009; Temin 2010). On this basis, the study did not include a control group,¹ which would have helped infer with a

Table 2 Percentage distribution of households' diet diversity score by treatment group

	Baseline				Post				P-Value	
	Cash		Food		Cash		Food		.155	0.146
	n	%	n	%	n	%	n	%		
Poor	22	13.3	34	19.9	4	2.7	7	4.8		
Moderate	97	58.4	100	58.5	72	49	85	57.8		
Good	47	28.1	37	21.6	71	48.3	55	37.4		
Total	166	100	171	100	147	100	147	100		

Source Authors' own from Kawana *et al.* (2012).

greater deal of certainty that the changes being seen in the key outcome indicators were due to the effect of study interventions. This omission also had a significant bearing on how results were analysed and interpreted. Finally, the study did not directly collect enough data to help analyse which transfer is more cost-effective.

4 Study data collection and management

Following a five-day training workshop for research assistants, and pre-testing of the questionnaires, data collection was undertaken at three different intervals: baseline, midline and endline. The baseline was undertaken within the first week of enrolment for each client, with baseline data collection spanning a period of seven months, from August 2010 to March 2011, as clients were successively enrolled as they initiated ART. The midline was undertaken four months after the baseline visit, over the period December 2010 to June 2011, while the post-assessment was undertaken eight months after the baseline, during May 2011 to November 2011.

These surveys were conducted at household level, collecting data on household variables such as the social demographics and food consumption diversity (household dietary diversification). Individual client data were also collected, including anthropometric data, CD4 counts and adherence levels. The CD4 counts and adherence data of the study clients were obtained from ART clinical records at the St Francis Mission Hospital.

Data were entered using CPro version 4.1, which was then exported to the Statistical Package for Social Scientists (SPSS) version 15.0, for cleaning and analysis. The nutrition status of adults was determined by calculating the BMI using weight and height in SPSS. In this study, BMI is classified as follows: less than 16.0 is severely underweight; 16.00 to 18.49 is moderately underweight; 18.50 to 24.99 is normal; 25.00 to 29.99 is overweight; and 30 and above is obese. For HDDS, a household was classified as having poor HDDS if they had consumed three or less food items in the previous 24 hours, moderate HDDS if they consumed between four to six food items and good HDDS if they consumed seven or more food items. Lastly, low CD4 count was classified as less than 200cells/l, moderate as 200.1–349.9cells/l, and high as above 350cells/l.

Descriptive statistics were generated to profile the demographic and socioeconomic characteristics of the

households and clients on the two treatment groups. In addition, chi-square tests with significance level set at 95 per cent were used to assess associations between outcome variables (adherence, CD4 count and nutrition status) and socioeconomic characteristics of study subjects, by treatment groups. Paired sample tests were used to compare effects of the treatment at different intervention times in the respective intervention groups, while independent t-tests were used to compare the means of the continuous outcome indicators for the two treatment groups (cash and food).

Finally, detailed qualitative case studies were carried out, by CARE International, on 17 clients, to compare subjective views on the impact and effectiveness of the two transfer types (Kawana *et al.* 2012).²

5 Study results

A total of 351 clients were enrolled in the study, with 175 on cash and 176 on food transfers at baseline. Data analysis disqualified 13 clients (3.7 per cent, 8 and 5 on cash and food respectively) for being above the required age of 55 years, and so at baseline, only 338 study clients were included in the analysis (167 on cash and 171 on food). At post-assessment, a total of 293 clients of the 338 completed the whole period of eight months of intervention, 147 and 146 on cash and food transfers respectively. This attrition rate of 13.3 per cent is attributable to deaths of 12 clients (3.6 per cent), while 33 clients (9.8 per cent) voluntarily dropped out. In some cases, clients relocated from the study area to another location where it was not possible for them to continue receiving the services provided by the study. Another reason for drop-out was related to stigma, whereby certain clients felt that continued collection of the transfers and follow-ups by research assistants compromised their confidentiality. Other clients had preference for a particular transfer type, especially cash rather than food, and so decided to drop off the study. Lastly, some economically better-off clients, by virtue of having a steady income, felt that they did not need this kind of support.

Both groups of study clients, cash and food, exhibited similar demographic and socioeconomic characteristics at baseline, entailing that the covariates and the key outcome variables were fully balanced between the treatment arms. This also suggested that the characteristics of the households and clients on cash and food transfer were

Table 3 Adherence to ART among clients

Adherence	Baseline assessment				Post-assessment			
	Cash		Food		Cash		Food	
	n	%	n	%	n	%	n	%
Good adherence	118	94.4	113	94.2	145	100.0	144	99.3
Bad adherence	3	2.4	1	0.8	-	-	-	-
Other	4	3.2	6	5.0	-	-	1	0.7
Total	125	100	120	100	145	100	145	100

Source Authors' own from Kawana et al. (2012).

similar and the randomisation process was a success. Therefore any comparison carried out between the two groups and changes in the key outcome variables to determine the impact and effect of the treatments can be ascribed to the effect of the interventions.

5.1 Nutrition status of study clients

From baseline through to post-assessment, there was a significant increase in the percentage of clients falling in the normal BMI category in both groups. There was also a notable decline in the proportion of study clients on cash transfer who were moderately or severely underweight, from 27.1 per cent to 7.4 per cent (see Table 1). Similar observations were noted among clients on the food transfer scheme (21.7 per cent at baseline, to 13.7 per cent at endline). A chi-square test of independence using Fisher's exact two-sided test showed that at both baseline and post-assessment, clients' nutritional status as measured by BMI was independent of the transfer type ($p=0.754$ and $p=0.317$).

The mean BMI for study clients also showed an increase for both treatment groups. The mean BMI for clients receiving cash increased from 20.42 to 21.88, while those receiving food saw their mean BMI increase from 20.74 to 21.75. A paired samples *t*-test was conducted to compare the baseline mean BMI of clients on both treatment groups to the midline and post-assessment BMI means. The results show that the increase in mean BMI from baseline to midline was statistically significant in both treatment groups [$t(123) = (-4.55)$, $p<0.001$ on cash and $t(125) = (-2.36)$, $p=0.020$ on food]. The results were similar from baseline to post-assessment [$t(124) = (-6.64)$, $p<0.001$ on cash and $t(116) = (-4.86)$, $p<0.001$ on food]. There were, however, no significant differences in the effect of the different transfers on mean BMI.

5.2 Household food availability and dietary diversity

During all the three assessment points, the main source of staple food was monitored. 'Own harvest' was the most important source of staple food for most of the study clients at all of the three assessment points, for both transfer types. The assessment results also showed that 'purchase' was becoming an important source of staple food for clients on cash transfer, as the study was being implemented. Compared to 32.3 per cent of client's households on cash transfer that were purchasing staple food at baseline, 46.9 per cent were purchasing staple food at endline, whereas for those on food transfers, the percentage of households purchasing staple foods fell,

from 28.1 per cent at baseline to 12.2 at endline. A chi-square test of independence using Fisher's exact two-sided test showed that at baseline, households' most important source of household staple was independent of the transfer type $p=0.710$, while at post-assessment, there was a statistically significant relationship between households' most important source of staple and treatment type $p<0.001$.

In terms of dietary diversity, Table 2 shows that in both treatment groups, poor diet diversity score (DDS) (less than three food items) decreased over the eight months of intervention, while good DDS (seven or more different food items consumed) increased, from baseline, midline until post-assessment, in both treatment groups. Households with a client on cash transfer had rates of good DDS, increasing from 28 per cent at baseline to 48 per cent at post-assessment, compared to an increase from 22 per cent to 37 per cent for those on food. A chi-square test of independence showed that at both baseline and post-assessment, household DDS was independent of the transfer type ($[\chi^2(2, df=6, n=337) = 3.734, p=0.155]$ and $[\chi^2(2, df=2, n=294) = 3.926, p=0.140]$).

Mean HDDS for households on cash transfer increased from 5.5 to 6.5, while for those on food transfer it increased from 5.1 to 6.4 at post-assessment. A one-way repeated measure Analysis of Variance within groups (ANOVA) showed that there was a significant increase in HDDS across the three different time periods [Wilks' Lambda = 0.808, $F(2, 290) = 34.399, p=0.001$, multivariate partial eta squared = 0.006]. However, there was no significant difference in HDDS between the two treatment groups across the three different time periods [$F(1,291) = 1.730, p=0.189$].

5.3 Adherence to ART

One of the key outcome variables of this study was the adherence to ART by study clients. Determining adherence to ART in HIV patients puts into consideration a composite of factors. These factors include the number of doses missed by the patient due to varied reasons, such as if the patient gave some pills to another person, and whether the patient has access to a treatment supporter and home-based care services.

The study results clearly show that more than 95 per cent of the study clients in both treatment groups had good adherence at all the three survey points (one study conducted in rural Zambia in 2009 showed that of patients

Table 4 Cost-effectiveness of food and cash transfers on nutrition (BMI)

Statistic	Programme type	
	Food	Cash
Mean BMI	21.94	21.37
Std error (SE)	2.65	0.46
BMI CI: 95% (low-upper)	19.29–24.59	20.91–21.83
Cost of transfer (8 months) in US\$	523.20	427.44
Cost-effectiveness ratio (CER) interval	21.28–27.12	19.58–20.44

Source Authors' own from Kawana *et al.* (2012).

for whom pill counts were available, 83.7 per cent had optimal (≤ 95 per cent) adherence). The highest adherence score was recorded during the post-assessment, where study clients on cash and food transfer had 100 per cent and 99 per cent adherence status respectively (see Table 3). A chi-square test of independence shows that at baseline, study clients' adherence was independent of the transfer type [X^2 (df=1, n=245) = 1.407, $p=0.937$]. In addition, at post-assessment, chi-square test of independence using Fisher's exact two-sided test showed that clients' adherence to treatment was independent of the transfer type ($p<0.001$).

5.4 CD4 count

The CD4 lymphocyte count is an excellent indicator of how healthy the immune system is. In HIV-infected people, the level of CD4 cell counts can predict how fast or slow the final stages of AIDS is progressing in an HIV-positive patient. The distribution of CD4 count by transfer type at the two reference points, from baseline assessment to post-assessment, showed a slight reduction in the number of clients with CD4 count below 200 cells/ μL , in both transfer groups. The study results also showed that the proportion of study clients with CD4 count above 350 cells/ μL was increasing from baseline to post-assessment, in both transfers. An increase would be expected with ART alone, even without nutrition support, and so may well be a reflection of increased adherence rates. However, studies have shown that malnourished people are less likely to benefit from antiretroviral treatment (see, for example, studies cited at www.avert.org/hiv-and-nutrition.htm), and so the improved nutrition outcomes reported above in Section 5.1 may also be contributing to improved effects of ART on CD4 count, although the lack of a control group makes this impossible to quantify. A chi-square test of independence shows that at both baseline and post-assessment, study clients' CD4 count was independent of the transfer type [X^2 (df=2, n=338) = 1.065, $p=0.587$ and X^2 (df=2, n=294) = 0.751, $p=0.687$].

Mean CD4 count increased among both cash and food transfer treatment groups, from 202.2 at baseline to 363.9 at post-assessment for clients on cash, and from 212.5 at baseline to 352.1 at post-assessment for clients on food. A paired samples *t*-test was conducted to compare the baseline mean CD4 count of clients on both treatment groups to the CD4 count means attained at both midline and post-assessment. The results show that the increase in mean CD4 count from baseline to midline was statistically

significant in both treatment groups [$t(159) = (-7.42)$, $p<0.001$ on cash and $t(161) = (-5.64)$, $p<0.001$ on food]. The picture was also the same from baseline to post-assessment [$t(146) = (-13.55)$, $p<0.001$ on cash and $t(146) = (-10.03)$, $p<0.001$ on food].

6 Client preferences

The majority of the 17 clients interviewed for the qualitative study (CARE International Zambia 2012) stated that they preferred cash over food transfers. Among the ten clients interviewed who received cash, eight stated that they preferred it this way, and two of the six clients on food transfers would rather have received cash, with one of them even selling some of the received food to convert it into cash. Most clients pointed out that cash can be used to buy food and to pay for other expenses such as clothes, school fees, agricultural inputs and house-building. Many mentioned the need to look beyond the ART study by investing in the future.

7 Cost-effectiveness

The values of the cash transfer and food basket were the same in this study, as were the costs of producing an e-voucher (scratch card for each client), the transaction fees for the e-vouchers, and the commissions paid to the delivering agent. Overall, the total cost of both cash and food transfers was US\$323 over the eight months. A separate study was therefore carried out by one of the authors (Tembo and Mwansakilwa 2013), to project the costs of transferring cash or food, based on the amounts and values distributed in the ART study, assuming that these would be scaled up by the government. The estimated costs of transferring food were taken from WFP figures from 2006 from Zambia, compounded to 2011 equivalents, while the costs of transferring cash were taken from average costs from the Social Cash Transfer Programme during 2010–12. The study concluded that it would cost US\$25.31 in 2011, to transfer US\$28.12 (the compounded value of the WFP standard food basket) to intended beneficiaries, compared to a cost of transferring an equivalent in-kind food basket of US\$37.28.

Table 4 shows that the cost-effectiveness ratio (CER) of a cash transfer on BMI was not only lower, but also lies within a smaller 95 per cent confidence interval (CI) (of 19.58–20.44, compared to that of an equivalent food transfer, 21.28–27.12). This suggests that cash transfers are not only cheaper but also more cost-effective in improving the nutrition of recipient individuals than food aid.

8 Conclusions

The study shows that there were significant improvements in the key outcome indicators for both transfer groups, over the eight months of cash or food support. Significant improvements were noticed in the mean *CD4* count in both treatment groups, *adherence* to ART and nutrition status as measured by the Body Mass Index (*BMI*), as well as Household Dietary Diversity Scores (*HDSS*). However, when the two treatment groups were compared, the study showed that both groups responded similarly to the treatments, whether cash or food. The results also clearly suggest that there were enormous amounts of similarities in other characteristics at final assessment between the two treatment groups, as was the case at baseline and midline assessments. Therefore, the conclusion made from these findings is that the provisions of cash or food for eight months when clients start ART confer equally positive effects in improving clients' nutrition and health.

In the Zambian context, where poverty and undernutrition levels are very high, adequate nutrition support is necessary for some households to ensure the optimal benefits from antiretroviral treatment. The study has

shown the benefits of such support to vulnerable clients, and made a strong case for limited nutrition support (perhaps six to eight months) to be provided to vulnerable households to ensure high treatment uptake and adherence until patients are well enough to return to their productive lives.

Given similar effects of cash and food, and the likely greater cost-effectiveness of transferring cash rather than providing food, cash transfers or social protection should be considered as a cost-effective strategy in Zambia to help people affected by HIV regain their strength and lead productive lives, as well as to support effective treatment scale-up. The Government of Zambia's new National Food and Nutrition Strategic Plan, which promotes strengthening the linkages between nutrition and HIV under Strategic Direction 6, including the need to provide food security or social protection for vulnerable HIV-affected households, as well as the scale-up of the Social Cash Transfer (to cover 50 districts in 2014 and all 104 districts in 2015), provides the policy framework and a cost-effective vehicle to start providing such support for the most vulnerable clients starting ART.

Notes

- 1 Because of the existing evidence of positive effects of nutrition support for clients starting ART, approval from the Ethical Review Board in Zambia would not have been obtained had there been a control group.
- 2 The full study is available online at: www.scribd.com/doc/227599322/A-Study-to-Compare-the-Effects-of-Cash-and-Food-Transfer-Schemes-on-HIV-Patients-Initiating-Antiretroviral-Therapy-ART (accessed 2 June 2014).

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Spirulina Effectiveness Study on Child Malnutrition in Zambia

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Abstract Ensuring adequate nutrition among vulnerable children has been a serious challenge in Zambia. Chronic child malnutrition is more predominant at 45 per cent while underweight and wasting are at 15 and 5 per cent respectively. This study tested the effectiveness of spirulina on malnourished children in Zambia. The study took place from June 2012 to February 2013. Sixty children were divided into spirulina treatment and control groups. The outcome of taking spirulina was analysed by collecting anthropometric data. The fixed-effect regression result showed that 10g of spirulina dairy intake leads to improvement by producing 0.29 higher points in the height-for-age z-score (HAZ); confidence interval (CI)[0.0404, 0.535]. On the contrary, the weight-for-age z-score (WAZ) and the mid-upper arm circumference z-score (MUACZ) did not show a significant difference, although treated children showed a larger improvement by 0.09 points and 0.38 points, respectively. This study implied the validity of spirulina in reducing chronic malnutrition.

1 Introduction

Sub-Saharan Africa has one of the most serious rates of chronic malnutrition in the world. In Zambia, the setting for the current study, chronic malnutrition or stunting affects 45 per cent of children under five. This remains the most common nutritional disorder, being slightly above the sub-Saharan Africa average of 42 per cent (CSO 2009) and the eighth highest rate in the world (UNICEF 2013). In addition, micronutrient deficiencies are having an enormous impact on children's health. Around 50–55 per cent of children in Zambia suffer from vitamin A deficiency and iron deficiency (CSO 2009). On the contrary, indicators of acute malnutrition remain comparatively low. Five per cent of Zambian children are wasted while 15 per cent are underweight.

The Zambian nutrition profile shows that 60 per cent of households cannot afford three meals per day (FAO 2009), which leads to inadequate nutrient intake and malnutrition. The same research shows that in the 2000–02 period, the dietary energy supply was only 1,905kcal per capita/day (*ibid.*). This indicates that households' actual calorie intake is lower than the estimated necessary requirement of 2,056kcal per capita/day. Carbohydrates such as cereals and starchy roots are the main source of energy which account for 80 per cent of the total energy intake (*ibid.*). This suggests that the intake of other essential nutrients as well as protein and lipids is generally insufficient.

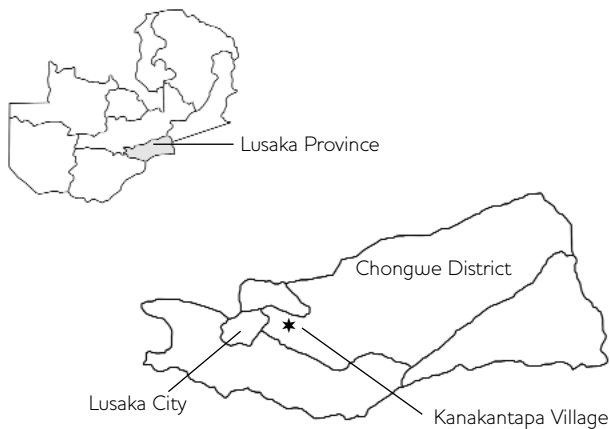
Health promotions targeting knowledge enhancement about maternal and child nutrition and direct nutrient supplementation are often utilised as nutrition intervention programmes in developing countries. In 2008, *The Lancet* published a series of papers on maternal and child undernutrition in which the need to focus on the crucial period from conception to a child's second birthday

was identified. In those articles, various intervention programmes were evaluated based on their cost-effectiveness and Bhutta *et al.* (2008, 2013) reported that breastfeeding promotion and support have the largest effect on child malnutrition, followed by vitamin A supplementation, zinc supplementation and balanced energy protein supplementation.

Spirulina is a blue-green micro-algae indigenous to Africa. It has been suggested that it has the ability to modulate immune function and can be used to treat several diseases (Karkos *et al.* 2011). It is proposed that it can sustainably contribute to alleviating malnutrition because it is rich in various nutrients, is easy to produce, and can be added to many traditional foods (Hug and Weid 2011). Spirulina contains various nutrients such as protein, beta-carotene, iron and vitamin B, which are usually deficient in undernourished populations (Belay *et al.* 1993). Thus, the use of spirulina may be an effective intervention tool to tackle protein deficiency, vitamin A deficiency and iron deficiency, which are common public health problems in Zambia.

In nutrition literature, several in vitro and animal testing studies have provided the evidence of efficacy of spirulina on the treatment not only for lifestyle-related diseases but also infectious diseases. For example, Iwata, Inayama and Kato (1990) showed that spirulina increased lipoprotein lipase activity and alleviated the hyperlipidemia condition in rats. Rodriguez-Hernandez *et al.* (2001) and Ble-Castillo *et al.* (2002) also found that spirulina could be utilised to prevent fatty liver formation. Furthermore, it is reported that spirulina produces an anti-virus effect, such as the inhibition of HIV-1 replication and herpes simplex virus type 2 (Ayehunie *et al.* 1998; Hernandez-Corona *et al.* 2002), and an anti-oxidative effect against lead-induced toxicity (Upasani, Khera and Balaraman 2001; Upasani and Balaraman 2003). A few clinical studies also revealed

Figure 1 Study area location



Source Authors' own adapted from www.diva-gis.org/Data.

spirulina's significant efficacy on lifestyle diseases patients such as reducing weight and blood cholesterol among ischaemic heart disease patients (Ramamoorthy and Premakumari 1996), decreasing serum cholesterol levels among hyperlipidemia patients due to nephrotic syndrome (Samuels *et al.* 2002), and regulating serum glucose and cholesterol levels among type 2 diabetes patients (Parikh, Mani and Iyer 2001). In addition to the effects on these diseases, the beneficial effect on serum iron levels and blood haemoglobin levels was suggested in both animal testing and clinical studies (Kapoor and Mehta 1998; Mani *et al.* 2000).

However, as yet, there are only a few studies which have examined the effectiveness of spirulina on human growth, particularly on weight gain. Azabji-Kenfack *et al.* (2011) studied its effectiveness on the nutritional status of 56 malnourished HIV-infected adult patients aged 18–35 in Cameroon by comparing changes in the nutritional status of patients in two groups; the first group received spirulina and the other groups received soya beans. In this study, they concluded that dairy intake of spirulina for 12 weeks significantly improved weight and BMI among patients who received spirulina. Yamani *et al.* (2009) also tested spirulina's effectiveness among HIV-infected patients and found that its dairy intake for six months improved the weight and arm girth of the patients. However, the results from these studies must be interpreted carefully because time trends which affect the nutritional status of patients, such as seasonality in harvested crops, failed to be taken into account. The most relevant studies to this present research are two experiments conducted by Simpore *et al.* (2005, 2006). Simpore *et al.* (2005) examined spirulina's effects among HIV sufferers aged under five in Burkina Faso. They created four groups by dividing participants into treatment and control and HIV-positive and HIV-negative groups (positive group: 84 children and negative group: 86 children). Traditional mealie meal with spirulina was provided to the treatment group, while the control group received just mealie meal. Weight gain and haemoglobin improvements were reported in the groups supplied with spirulina, particularly the HIV-negative children. Another study that investigated similar groups found that a combination of spirulina and *misola* (millet, coja, peanut) was superior to spirulina or *misola* alone for nutritional rehabilitation of severely and moderately

Table 1 Anthropometric indicators at screening point – Kanakantapa

Observations	295
HAZ (Average)	-1.33
WAZ (Average)	-0.27
MUACZ (Average)	-0.19
Stunted (under -2 HAZ)	36.5%
Underweight (under -2 WAZ)	5.1%

Source Authors' own.

underweight children aged 6–60 months (Simpore *et al.* 2006). However, these studies were not only conducted for a short duration (both were eight weeks), but they also did not precisely estimate the pure impact of spirulina by fully taking into account the time effect, including the impact of nutritional intake from traditional meals. A possible correlation between spirulina treatment status and other unobserved determinants of the outcomes were also not studied. Michaelsen *et al.* (2009) have recently suggested that the evidence of spirulina effectiveness is still sparse and that further research is required.

In relation to this, our study is the first research that rigorously explores the effectiveness of spirulina on the anthropometric nutritional status of malnourished children aged under three in Zambia using a panel data set. Three numeric indicators, height-for-age z-score (HAZ), weight-for-age z-score (WAZ), and mid-upper arm circumference z-score (MUACZ) were used to evaluate the effectiveness of spirulina.

2 Materials and methods

2.1 Study area

Kanakantapa Resettlement Scheme in Chongwe District, Lusaka Province was selected for implementing the project (see Figure 1). Kanakantapa is located approximately 60km from Lusaka City.

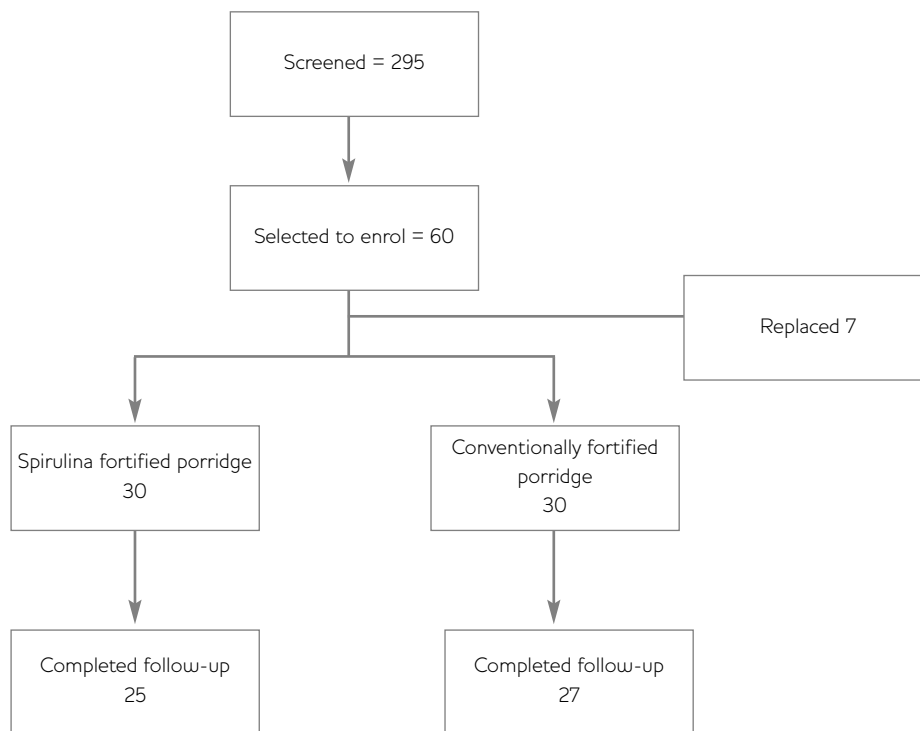
Kanakantapa was selected because neither the government nor non-governmental organisations (NGOs) were distributing food supplements there. In addition, the help of the local NGO, Programme Against Malnutrition (PAM), which has been running programmes in this area, made it easier for the community to gain confidence and to be willing to participate in the study.

Although the proportion of undernourished children in Lusaka Province is the lowest in the country, the most recent data available show that as many as 37.2 per cent of children are stunted and 15 per cent are underweight (CSO 2009). Moreover, when the children were screened in this study area in April 2012, 36.5 per cent of the sample were stunted and 5.1 per cent were underweight (see Table 1). The results of the screening undertaken in the study area correlated with the provincial averages.

2.2 Study design

A total of 60 malnourished children under five years old, and aged 18–36 months, were selected from a sample of 295 children who were screened at Kanakantapa Rural

Figure 2 Flow diagram of participants through the study



Source Authors' own.

Health Centre, Chongwe District using the weight-for-age, height-for-age and mid-upper arm circumference (MUAC) indicators.

The 60 chronically least-nourished children were evaluated on an index generated from simple summation of HAZ and WAZ scores. The division into treatment and control groups was undertaken by listing the 60 subjects in ascending order from mild to severely malnourished, which was evaluated by a simple summation of the weight-for-height z-score (WHZ) and MUACZ. Seven children dropped out of the study due to their family's refusal to participate or for other reasons. These children were replaced by other children.

Thereafter, the sample children were alternately divided into treatment and control groups from the top of the list in descending order. The two groups were further adjusted to ensure children were evenly distributed in relation to sex and geographical area. Therefore, our design is not perfectly randomised. However, as discussed in Sections 2.5 and 3.1, in addition to running the individual fixed-effect regression model, there is no significant difference in the socioeconomic characteristics of children across the two groups. Hence, possible bias caused by this adjustment can be seen as minimal.

The selected malnourished children comprised:

- a Treatment group, 30 children provided with spirulina; and
- b Control group, 30 children without spirulina.

2.3 Distribution of porridge blends

Porridge blends, a mix of 5kg of roller meal¹ with 300g of spirulina, 0.8kg sugar and 0.1kg salt, was distributed

monthly to the target group. Porridge ingredients were pre-mixed with spirulina so that participants could not just eat roller meal. Spirulina was procured from the USA through our partner, DIC Corporation, the largest spirulina producer in the world. The control group was provided with the same porridge blends but without spirulina. Mothers or caregivers of each child in both the control and target groups were told to feed porridge twice a day, in the morning and afternoon.

The porridge blends were provided monthly from June 2012 to February 2013. Physical measurements of weight, height and MUAC were recorded for both groups every month by trained Child Growth Promoters (CGPs) at each health post. CGPs are community health workers who are trained by the Zambian government to evaluate child growth. Participating children whose mothers or caregivers did not attend growth-monitoring sessions were followed up by CGPs unless they had left the village due to economic factors or family issues.

In case of missing values, the child was omitted from the analysis. However, children who could not continue participating in the project for various reasons in the first two months were replaced. Thereafter, no replacement occurred. Figure 2 shows the process of sample selection.

2.4 Data collection

Three indicators were used to assess the nutritional status of children under five years old: height-for-age z-score (HAZ), weight-for-age z-score (WAZ) and mid-upper arm circumference z-score (MUACZ). HAZ is an indicator of chronic malnutrition, while WAZ and MUACZ are indicators of chronic and current malnutrition and acute malnutrition, respectively.

Table 2 Balanced-check result for selected variables

Variable	Total n=60	Spirulina treatment group (T; n=30)	Spirulina control group (C; n=30)	T-C [SE]	Pr(T > t)
	Mean (SD)	Mean (SD)	Mean (SD)		
HAZ	-2.26 (0.86)	-2.26 (0.91)	-2.25 (0.82)	-0.01 [0.22]	0.97
WAZ	-0.67 (0.8)	-0.67 (0.95)	-0.71 (0.63)	0.04 [0.21]	0.83
MUACZ	-0.10 (1.03)	-0.22 (0.96)	0.01 (1.1)	-0.22 [0.27]	0.41
Child's age (months)	279 (5.58)	274 (5.28)	28.4 (5.91)	-1 [1.45]	0.49
Mother's age (years)	29.9 (7.54)	29.9 (1.4)	29.9 (1.5)	0.04 [2.03]	0.99
Mother's weight (kg)	60 (10.03)	58 (1.4)	62 (2.3)	-3.96 [2.7]	0.15
Mother's height (cm)	158.4 (5.6)	159.2 (0.8)	157.7 (1.2)	1.53 [1.51]	0.31
Mother's educated years	5.95 (3.19)	5.6 (0.6)	6.3 (0.6)	-0.61 [0.86]	0.48
Family size	3.63 (1.97)	3.9 (0.4)	3.4 (0.3)	0.54 [0.53]	0.31

Note SD = standard deviation. SE = standard error. Pr = p-value.
Source Authors' own.

The World Health Organization (WHO) Multicentre Growth Standards (De Onis and WHO 2006) were used as a guideline for nutritional status in the study. WHO and UNICEF define stunting as children whose height-for-age z-score is below minus two standard deviations (HAZ <-2) and underweight as children whose weight-for-age z-score is below minus two standard deviations (WAZ <-2). If these indicators are minus three (-3) standard deviations and below, the child's nutritional status is said to be 'severe'.

The *Anthro* software, designed by WHO, was utilised to calculate growth indicators using the height, weight and MUAC data. Length-for-age for children under two years old, and height-for-age for children aged two and above were measured according to WHO guidelines.

Anthropometric measurements were conducted by experienced CGPs. In addition, CGPs monitored compliance by regularly visiting participants' households.

2.5 Statistical methods

To measure the average improvement in children's nutritional indicators, the difference between February 2013 (endline) and April 2012 (baseline) was calculated, which is summarised in Table 3. Each index is standardised into z-score values. If there is no difference between the two periods, the implication is that the child grew according to the child growth curve.

Considering that division of sample children into target and control groups in this study was not perfectly

randomised, it is unclear whether the average difference was purely caused by spirulina because treatment status can be correlated to other unobserved determinants of nutritional outcomes. To control such factors, fixed-effect regression analysis was conducted, by exploiting the panel nature of our data set. The following is an explanation of the model used to estimate the pure impact of spirulina on child growth followed by the results.

Our identification strategy was to compare changes in the children's nutritional status in the households which received spirulina over the study period to those that did not. To determine the impact of spirulina, we ran individual-level fixed-effect regression models of the child's nutritional status on treatment status for each household. We denoted the health outcome of a child in household *i* in period *t* as y_{it} and the household's status in terms of whether it received spirulina as s_{it} . The regression model estimated was:

$$y_{it} = \beta s_{it} * Time_t + \delta Time_t + \lambda_i + \varepsilon_{it} \quad (1)$$

where $Time_t$ is a time dummy, which takes 1 for the observations from post-intervention, otherwise 0, λ_i is the full set of individual fixed effects. Coefficient β represents the pure project impact in the equation above under the assumption that *time-variant* unobservable characteristics, which affect the outcome of interest, are not different across samples in treatment and control households.

Overestimation of the project's impact may occur if households in the treatment group harvested significantly

Table 3 Differences between baseline and endline²

		Baseline	Endline	Change	t-value	Pr(T < t)
HAZ	Treatment	-2.24	-1.79	0.45	1.44	0.078
	Control	-2.15	-1.91	0.24		
WAZ	Treatment	-0.65	-0.55	0.10	0.63	0.263
	Control	-0.71	-0.70	0.01		
MUACZ	Treatment	-0.26	0.13	0.39	0.66	0.254
	Control	-0.31	-0.02	0.28		

Source Authors' own.

more crops than those in the control group during the study period. There is also a possibility that some kinds of intervention were made by other organisations that affected children in only one of the groups. However, there was no such occurrence during the study period according to the reports of the local staff including the CGPs.

2.6 Ethical issues

This health intervention project was approved by the University of Zambia Biomedical Research Ethics Committee (UNZAREC) in February 2012, the Ministry of Health, the National Food and Nutrition Commission (NFNC) and the District Health Management Team (DHMT). The study ensured voluntary participation, informed consent and confidentiality of mothers throughout the research period. Careful attention was given to children as much as possible to avoid any risk of harm during the study.

3 Results

3.1 Balanced check at baseline

A t-test was conducted to check whether any bias existed in the explained variables and other selected indicators such as HAZ, WAZ, MUACZ and children's age across the two groups. In addition, information on the mother's socioeconomic status (as measured by her level of education), and on family size was also collected and

examined. There were no statistically significant differences between the groups with regard to any of the variables (see Table 2). However, it may be important to note that the difference in MUACZ (0.23) was not small compared to the other two indices and thus close attention was paid to MUAC in the subsequent analysis.

3.2 Descriptive analysis of the baseline and endline data

The average improvement in the children's nutritional indicators and the difference between February 2013 (endline) and May 2012 (baseline), are summarised in Table 3. Each index is standardised into z-score values. If the difference between the two time points is positive, the implication is that the child grew as expected when evaluated against the standard children's growth chart.

On average, the change of children's growth in the treatment group was higher than the control group for all three indicators. For example, treatment children had an improved HAZ of 0.21 points more than control children.

3.3 Regression results

Table 4 shows the results of the regression analysis. It is evident that the time-treatment cross coefficient (β) is the pure project effect. The regression analysis for HAZ indicates that the treatment group improved by 0.29 points more than the control group on average. This was

Table 4 Impact of spirulina on child growth

	HAZ	WAZ	MUACZ
Mean at baseline	-2.26	-0.69	-0.1
Spilurina*Time	0.29** (0.12) [0.0404 , 0.535]	0.09 (0.13) [-0.183 , 0.355]	0.38 (0.28) [-0.188 , 0.942]
Time	0.16* (0.09) [-0.0236 , 0.350]	0.01 (0.11) [-0.203 , 0.226]	-0.07 (0.24) [-0.544 , 0.397]
Number of observations	110	111	111
Number of children	59	60	60

Note ** Indicates significance at the 5% level; * indicates significance at the 10% level. Numbers in parentheses are robust standard errors. 95% confidence intervals are shown in brackets. Individual fixed effects are controlled. One child is excluded from analysis due to the extreme value only for HAZ based on the approach proposed by Hadi (1994).

Source Authors' own.

statistically significant at the 5 per cent level. In addition, although insignificant, the regression analysis shows that the coefficient (β) is positive by 0.09 points for WAZ and 0.38 points for MUACZ.

4 Discussion

4.1 Effect on height

The results indicated that there was a significant difference in the change in HAZ during the study period between the children in the treatment and control group at the 5 per cent significance level. If this difference was attributable to spirulina intake, it implies that this fortification helped the treatment group children to grow 0.29 points more than the control group on average. The statistical difference in HAZ implies that spirulina consumption can be an effective food intervention particularly in Zambia, where severe stunting is widespread.

4.2 Insignificant effect on weight and mid-upper arm circumference

In terms of WAZ and MUACZ, there was no significant difference observed in the change in outcome between the children across the two groups. For WAZ, the marginal size of impact of spirulina is shown in the small point estimate of the Spirulina*Time (β) coefficient (0.09) (see Table 4). This result is possibly attributed to the small energy content of spirulina. Generally, weight reflects the short-term outcome of dietary intake and infection. Although spirulina contains a variety of important nutrients for child development, such as zinc, protein and other minerals, it does not contain much energy in 10g provided to children every day. Therefore, spirulina's rather small contribution in energy may have caused the effect of spirulina on weight to become smaller than the difference observed in height.

In contrast, as for MUACZ, it seems too early to conclude that spirulina has no impact given that Spirulina*Time (β) coefficient (0.38) (see Table 4) is relatively large. Indeed, the larger standard error of this coefficient (0.28) is likely to be attributed to the reason why the statistical test could not detect a significant impact on MUACZ. At baseline point, standard deviations of individual MUACZ were larger compared to the other two indicators (see Table 2). This might have been caused by measurement errors in the MUAC. The MUAC measurement depends relatively on where precisely the measurement is taken and how close-fitting the examiner makes the cord. However, if with a larger sample size, this issue about the power of the statistical test could be overcome. The estimate is that if with the sample of 240 or more children, we expect the effectiveness test to detect a significant impact under the given statistics.

4.3 Limitations

Although our study provides valuable evidence on the effectiveness of spirulina, there were several limitations to this study.

- a The study was not a double-blind randomised controlled trial with a placebo. Due to spirulina's green colour, mothers or caregivers knew that their children were in the treatment group. This knowledge might have caused changes in the behaviour of mothers in both groups. For example, given the rich nutrients that

are contained in spirulina, mothers in the treatment group may pay less attention to the child's nutrient intake from food other than spirulina. Also, it is possible that mothers from households excluded from this study or in the control group within the same health post might receive a small part of spirulina porridge from the treatment household since they acknowledge its effectiveness. However, all these examples will yield an underestimation of spirulina's impact, and thus our estimates are likely to be considered as the lower boundary of its true effect.

- b Because it was entirely up to the participating children whether to eat the porridge or not, there was still a problem of 'compliance'. The acceptance level of spirulina may be affected by several factors such as food preference, risk perception, socioeconomic status, and family members' situation. Still, the 24-hour record documenting the children's dietary intake, which was collected by authors to ensure compliance, indicated that generally most caregivers followed our feeding recommendations.
- c The drop-outs might have influenced the results. Because the original sample size was small, the population was susceptible to any change. If the reasons for dropping out were correlated with being in the treatment or control group, and were also correlated with unobservable variable(s) which might have affected health status, our results might have been biased (Fitzgerald, Gottschalk and Moffitt 1998).

4.4 Implications for future research and policy discussion

Although some previous studies have investigated the effectiveness of spirulina for nutritional rehabilitation and provided significant evidence of its effectiveness, most of them were small scale in size (Azabji-Kenfack *et al.* 2011; Simpore *et al.* 2005; Yamani *et al.* 2009). Unfortunately, the current study was no exception in this respect. Therefore, as we discussed earlier in Section 4.2, larger-scale studies are desirable in order to obtain more precise evidence for the effectiveness of spirulina on child growth, MUACZ in particular.

Since this micronutrient fortification project is one of many policies competing for limited government expenditure, the cost-effectiveness of spirulina intervention must be comprehensively studied to see if it should be a policy priority. By using the approach taken by Bhutta *et al.* (2008) and the market price of spirulina, our current estimate of its health cost-effectiveness is US\$73.7 per Disability-Adjusted-Life-Years (DALY) averted. This is higher than that of vitamin A and zinc fortification, US\$19 per DALY averted, which is considered as the most cost-effective intervention against child malnutrition in this region (Tan-Torres Edejer *et al.* 2005). However, due to the caveat of our study (i.e. ignoring spirulina's effect on important outcomes other than HAZ), our figure is likely to understate the true benefit of our intervention, and hence its cost-effectiveness. Thus, our estimate should be considered as upper bound in terms of true cost-effectiveness.

Indeed, in future studies the effects on other nutritional deficiencies such as vitamin A deficiency and iron

deficiency should also be considered. Previously, a micronutrient fortification intervention study conducted in Zambia resulted in improved iron status among children (CIGNIS Study Team 2010). Another study also reported that maize meal fortification not only improved iron status among children, but also vitamin A status among adolescents (Seal *et al.* 2008). It is possible that spirulina may also have a similar effect considering its highly nutritious content.

We also estimated the effectiveness of our intervention in the context of human capital investment. Alderman, Hoddinott and Kinsey (2006) revealed that the one unit improvement in HAZ of pre-school children significantly increases the number of grades of schooling completed by 0.68 grades. Using this evidence and our estimate of the project's impact, our intervention is likely to promote the educational attainment of a treated child by 0.25 grades. This educational benefit is converted to the increase in labour market earning potential using the private rate of return on education in rural Zambia estimated by Nielsen and Westergård-Nielsen (2006). Under the conservative assumption made by Miguel and Kremer (2004), our rough calculation suggests that the intervention using spirulina increases the net present value of life-time income by over US\$140 per treated child at a cost of US\$82.4. This implies that the labour market benefit of this nutrition fortification programme may be greater than its cost. Additionally, the cost of the intervention may even be lower once spirulina is domestically produced in Zambia, where its plentiful water and moderate temperature make it an ideal place for cultivation. Therefore, evidence from the feasibility study on domestic production will greatly contribute to the policy discussion.

In the case of introducing a health intervention using spirulina in Zambia, the cultural impact must be carefully observed. In Zambia, where green micro-algae have never been consumed, cultural barriers against this new food are likely to exist. Indeed, initially in our study, a few

Notes

- 1 Roller meal is made from maize and has an extraction rate of about 90 per cent.

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participants refused to continue due to their hesitation in consuming food that they had never eaten before. However, experience tells us that eventually such a problem can be overcome. As their children's health visibly improved by consuming spirulina, mothers became more dedicated to feeding it to their children. Even after six months of the termination of the spirulina effectiveness test, more than half of 60 sample households, including those in the control group, continued the habit of consuming spirulina, which is available at the study area's health posts for free. Active consumption, even in the absence of the study, implies that if supplemented with the results from the study or information from real cases, especially those involving neighbours or somebody potential consumers know, it will help people to overcome the cultural barriers. Thus, when spirulina intervention is extended nationwide, the role information can play to help potential customers overcome cultural barriers should be correctly understood by policymakers.

5 Conclusion

The main contribution of this study is to provide the evidence that a daily intake of spirulina significantly improves a child's HAZ by 0.29 units when the time effect and individual fixed-effect were controlled. The results from this study indicate that a combination of spirulina and mealie meal is effective in improving the linear growth in height for undernourished children. The uniqueness of this study project comes with its use of indigenous micro-algae in Africa. Utilising an indigenous resource is important for development projects in terms of sustainability and acceptability. In addition, spirulina can be produced with less water and energy than other foods promoted as a nutritional supplement for children, such as soybeans. The plentiful water and moderate temperature in Zambia is ideal for cultivation, although the production of spirulina is also well suited to hot, even desert countries. Thus, this nutrition fortification programme can be a good tool to alleviate nutrition problems in developing countries.

- 2 To compare between baseline and endline data, the authors use 52 purely comparable children. Thus, the baseline value is not the same as the balanced check result.

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The Rainbow Project: A Model to Fight Child Malnutrition in Zambia

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Abstract Child malnutrition in Zambia is a public health priority that must be addressed by networking local authorities, communities and non-governmental organisations (NGOs), through interventions focused both on treatment and prevention. The Rainbow Project, under the Pope John 23rd Association, is a large-scale model of care for orphans and vulnerable children which has been operating since 1998 in Ndola District. It runs a community-based programme that operates through supplementary feeding programmes (SFPs), run by local partner organisations and coordinated by professional figures working in cooperation with district health management teams (DHMTs). The Rainbow Project organises capacity-building activities for people involved in malnutrition projects at district and community level, radio programmes to sensitise civil society and avoid stigma, and urban agriculture horticulture programmes (container gardening). The networking community-based management is an effective and sustainable way to fight child malnutrition, a major killer for children under five in lower middle-income countries (LMICs).

1 Introduction

Malnutrition is a condition of poor nutrition, mainly used to describe undernutrition and refers to short- or long-term exposure to inadequate food in terms of quantity and quality.

Child malnutrition is a major global health concern especially among the poorest levels of society, leading to morbidity (malnourished children can become locked in a cycle of recurring illness that impairs immune function, intellectual development, working capacity and increased risk of disease in adulthood) (Michaelsen *et al.* 2009) and mortality (annually nearly three million of all deaths among children under five are due to malnutrition).

A Community-based Therapeutic Care (CTC) model was designed by Collins in 2001, integrating approaches of centralised in-patient treatment and community-based management treatment of severe acute malnutrition (SAM) (normalised weight-for-height score below -3 standard deviations) and moderate acute malnutrition (MAM) (normalised weight-for-height score below -2 standard deviations) (Collins 2001).

A general CTC model is based on four key components:

- *Community mobilisation* aimed at stimulating, involving and sensitising the local population to the problem of SAM and MAM;
- *Supplementary feeding programmes (SFP)* for children with MAM and no medical complications, providing supplementary food to take home and sensitisation for caregivers;
- *Outpatient therapeutic programmes (OTP)* for children with SAM without medical complications, providing ready-to-use therapeutic food (RUTF) and routine medication to take home; and

- *Stabilisation centre* for children with SAM with medical complications, providing therapeutic milks and specific medical treatment.

If properly performed and implemented on a large scale, community-based management of SAM could prevent the deaths of hundreds of thousands of children (Valid International 2006).

The first CTC programme was introduced in Lusaka District, Zambia in 2005.

Zambia has made great strides towards economic growth in recent years. In 2012 the World Bank reclassified the country as 'middle-income'. However, the economic growth has not translated into significant poverty reduction (UNDP 2013). Today Zambia is still facing major developmental challenges that include widespread poverty, HIV/AIDS, food and nutrition insecurity.

We now discuss the Rainbow Project, a CTC model, and its approach to malnutrition care, treatment and prevention in Ndola District.

2 The Rainbow Project

The Pope John 23rd Association is part of the Associazione Comunità Papa Giovanni XXIII that was founded in Italy by Father Oreste Benzi in 1968. The Association is a single spiritual family, composed of people of different ages and states of life, who are committed to answering the universal call to holiness, contributing to the realisation of the Kingdom of God and participating in the mission of the Church.

The Rainbow Project, under the Pope John 23rd Association, is a large-scale model of care for orphans and vulnerable children that has been operating since 1998 in Ndola and Kitwe Districts.

Rainbow supports different organisations in terms of financial, technical and logistical support for different programmes, including the one that addresses malnutrition.

The nutrition programme is present in 12 areas around the city of Ndola, collaborating with ten small non-governmental organisations (NGOs) and community-based organisations (CBOs). The different NGOs/CBOs are included in a networking system and the leaders of the different organisations (operators) meet regularly at the Rainbow office to discuss interventions and challenges regarding malnutrition.

The programme for malnutrition has several components that will be discussed separately to analyse the challenges they face and the achievements they have realised.

3 Supplementary feeding programmes (SFPs)

There are 13 SFPs in the Ndola area. All the centres are run in close collaboration with the local authorities (LAs) such as the district health management team (DHMT) and coordinated by professionals.

In the context of a traditional CTC, SFPs aim to treat MAM, thereby preventing deterioration into SAM. They also give long-term sustenance to recovery from SAM after outpatient or in-patient treatment. In international publications several guidelines regarding the different contexts for MAM interventions are discussed. In Ndola District the CTC does not cover the whole district and the availability of RUTF has been restricted and erratic at times, because the reporting and delivery system of the consignment has not been working properly. We have therefore included the children with SAM in the SFPs.

The SFPs are located in different areas, with 11 operating in ten different compounds of Ndola District and the remaining two being in rural areas. All the centres are run by operators from local organisations assisted by community volunteers of the same CBOs/NGOs, and operate in networks with the local clinics. Every centre can accommodate 25–30 moderate and severely malnourished children from six months to five years old. The activities for SFPs take place once a week. All the children referred from local clinics, hospitals, weighing points or from communities should be admitted into the programme if they meet specific criteria on admission (mid-upper arm circumference (MUAC) < 12.5 cm or bilateral pitting oedema or weight-for-age < -2 SD).

3.1 SFP activities

Anthropometric measurement and recording. Malnutrition indicators (weight, MUAC and bilateral pitting oedema) are checked at the SFP locations. Children found with any medical complication are immediately sent to the nearest local health facility for further investigation. All the data are recorded in specific registers to assess the child's individual growth and to monitor the evolution of the malnutrition rates.

Cooking demonstration. A balanced meal using locally available food is cooked by guardians under the close supervision of operators/helpers of the centre. Because the diet of these communities is often based on starch-rich

staples and minimal amounts of protein source foods, dietary management of malnourished children is based on improving the existing family diet. SFPs are provided with specific food allocations and follow the recipe book developed by the Ministry of Health to facilitate the introduction of traditional recipes for the different seasons of the year.

Meals together. A balanced meal is offered to all the children. Monitoring children during the meal is important to observe appetite and consumption patterns, and children who lack an appetite are referred to the clinic.

Health talks. Different topics – including hygiene, HIV/AIDS, child diseases and vaccines – are discussed by community health workers or lay counsellors with the guardians. Very often the environment in which the children live is unhygienic, resulting in exposure to recurrent infections through contaminated water, soil and pests. The awareness and knowledge provided in terms of health and hygiene remains as a personal and community heritage, locally relevant in an attempt to ensure effective practical implementation which translates into adequate home care. Different training materials have been provided to all the SFPs, including HIV nutrition counselling cards, infant and young child feeding (IYCF) documents and self-produced pamphlets.

Distribution of food supplements. Locally available food, including groundnuts, mealie meal, beans, sugar and cooking oil, as well as High Energy Protein Supplement (HEPS), is distributed every week. Food insecurity is a serious problem in the district and it is quite common for families to have only one meal per day. In addition, contributing to the household food security allows the mother to spend more time with her children, especially when they are sick. However, we recognise that food hand-outs can create a degree of dependence. In a few cases, it was observed that guardians refused to feed their children properly to avoid being discharged from the FSP.

Home visits allow volunteers to ensure that the food is correctly used for the children for which it is intended and not misused or sold. Malnutrition is a complex and multifactorial problem that starts at household level, so the rehabilitation of the child needs to include monitoring at home. Moreover, volunteers are able to identify the most vulnerable families and understand their specific needs.

In 2012 Rainbow SFPs in Ndola accommodated 1,088 malnourished children, with the following outcomes: 81 per cent cured, 7.5 per cent death rate, 11.5 per cent defaulters. The high mortality rates (SFP standards recommend not more than 3 per cent) are probably due to the inclusion of SAM children in the same programmes. With the inclusion of the SAM children the outcome for mortality meets the international Sphere Standards of less than < 10 per cent (Sphere Project 2004).

4 Outpatient therapeutic programmes (OTPs)

In 2008 the Rainbow Project started the first OTP in Ndola District. Contacts were made, with the support of the local DHMT, with Valid International, which conducted the preliminary trainings.

HIV and malnutrition screening was conducted in all SFPs to detect both HIV and SAM prevalence prior to starting the clinics. After collection of the data the OTP started at six sites, each run by a doctor from the Rainbow Project and a nurse from the DHMT. This liaison demonstrated the importance and viability of the networking between NGO and government.

At the start there was stigma and ignorance regarding malnutrition and the use of RUTF. With time the results were remarkable and the OTP has become busy and effective (from July 2008 to May 2011 district internal data report 827 new admissions; 73 per cent discharged as cured, 23 per cent default, 2 per cent non-cured, 2 per cent death rate). The biggest challenge to its effective operation has been the erratic supply of RUTF, which has put the survival of many severely malnourished children at risk.

After several orientations and intensive training, the Rainbow Project handed the OTPs over to the district in 2011. The six OTPs are kept up to date under the supervision of the nutritionist from the DHMT.

The importance of treating malnutrition in outpatient facilities is still not always fully understood, as the old adage that 'in-patient treatment is best' has not been eradicated in all health workers and lack of integration between the OTPs and routine running of the local clinics has in some cases disrupted the effectiveness of the programme itself.

5 Container gardening programmes

Starting in 2011 container gardening programmes were put in place for guardians accompanying children to SFPs. The aim was to improve the family diet through their own production of local vegetables to help meet nutritional needs. The programme was run by the Rainbow Project with the contribution of a local expert in agriculture and was endorsed by LAs. Tools, including seeds, containers and two days of agronomy workshops were provided. All the beneficiaries were followed up at home at least twice (at the beginning and for the follow-up).

By 2012, 190 guardians had benefited from the programme. Despite some challenges including access to water, soil composition and village chickens and rats eating the seeds, an internal monitoring survey showed that more than 70 per cent of the women involved were still cultivating and producing enough vegetables to meet home consumption needs on the second visit. Moreover, 11 per cent of the guardians have used the programme for income-generating purposes by selling part of the crops harvested.

The feasibility of rehabilitating malnourished children at household level depends on the family's access to food. Implementation of nutritional programmes with urban agriculture/horticulture components may have a key role to protect food security and to promote food diversity in the family.

6 Capacity building

At district level in the last few years, Rainbow has sponsored workshops and trainings for both nurses and doctors on the integrated management of MAM, SAM, HIV and nutrition, both in the OTP and the hospital setting.

At community level, similar training has been conducted both with the operators of the project itself and with community health workers from different local clinics (e.g. IYCF training, HIV and nutrition courses).

Supervision is one of the challenges of the capacity-building exercise. From our experience, lack of proper and continuous supervision results in frustration and makes the trainings and workshops a fruitless exercise.

Several radio programmes on nutrition issues and horticulture have also been aired to sensitise civil society and in this way to bring nutrition education closer to household level. The majority of the programmes were run with experts from LAs. Knowledge helps to reduce stigma and allay fears, including witchcraft, which is still a very real consideration in the poorest communities.

The need for competent and knowledgeable health personnel is vital for malnutrition reduction and every effort must be made to bring each health worker and community volunteer up to a standard at which they are able to recognise malnutrition and guide the patient through the correct treatment.

NGOs/CBOs should refer to LAs for trainings and workshops where the LAs have the capacity to perform those activities in order to allow all professionals and volunteers of the community to 'speak the same language' and 'share the same message'.

7 Monitoring and evaluation

Up to the time of writing, a proper impact evaluation of the Rainbow Project has not been conducted. In the absence of a baseline survey, impact would have to be assessed by matching Rainbow communities with other communities on key time-invariant characteristics and then retrospective questions asked to check that the groups were indeed similar at the start of the Rainbow Project.

A first process external evaluation of the activities of the Rainbow Project was conducted in 2002, examining the work of the whole project (Reijer 2002). The evaluation suggested identifying clear guidelines about when to refer a child to the clinic and how to improve the monitoring and evaluation system, and highlighted the need to standardise the protocols of activities for all the centres also in terms of food items to be taken home (it was suggested introducing HEPS in the home food ratio). It was also recommended to improve capacity building with the staff and look for additional sources of funding.

Since 2006, data from all the Rainbow activities – including specific field visits, questionnaires, registers, monthly monitoring tools and reports – are collected at community level and reported to the Rainbow office. All the data are fully available to the DHMT and are shared among the network system. In the last few years data from SFPs have been internally analysed to evaluate the validity of the intervention compared to international standards.

While the collection of data on a monthly basis is demanding, it is vital for Rainbow interventions to be accurately targeted, complete and to meet required

standards and norms. For example, through the review of our annual/monthly data we discovered a noticeably high percentage of defaulters, even if still below 15 per cent. As reported in other publications (Navarro-Colorado, Mason and Shoham 2008), the causes of defaulting may be influenced by seasonal factors, when access to the centres is reduced due to the rain or when in the harvest months other activities take priority for the members of the family, or by the performance of a single centre across all the activities. SFPs were also subjected to two external evaluations by Zambian professionals after the IYCF training, in 2012 and 2013.

The two evaluations have allowed the project to identify areas of weakness and strength and adjust interventions accordingly.

The first evaluation showed poor written planning and target identification, a lack of documentation of the activities conducted in the centres and a lack of supervised counselling. To standardise the activities we have created and printed a register for each centre to help operators document all the activities. We have also tightened up the supervision as part of technical support.

In the second evaluation, some areas of intervention, especially regarding the nutritional counselling, were identified. It helped us to see that our individual nutritional counselling was having trouble with identifying food quality assessment and failing to emphasise adequate (quantity and quality) food intake for catch-up growth of the malnourished child. We finally realised that nutritional counselling cannot be implemented by community staff despite all the meetings and trainings undertaken over the years and that it must be carried out by professionals, including nutritionists and trained nurses. Theory must be clearly and practically translated into real-life scenarios in order for it to be meaningful and become sustainable and it has to be given at the right time and place. It plays a key role not just to cure but also to prevent malnutrition. We acknowledge that Rainbow needs to do better in this regard.

A strong monitoring and evaluation system is essential for the effective functioning of any nutrition project. Monitoring is linked to project management and designed to assess and improve project performance while evaluation permits decision-makers to assess whether project objectives are met (Levinson *et al.* 1999). But critically, a supervisory system must be implemented and budgeted for before starting any programme.

8 Discussion and conclusion

Malnutrition is not a single-sector health/social-related issue but rather a complex issue that needs to be addressed at multiple levels of society and health-care platforms. It is unrealistic that government or NGOs can sustain such a holistic approach in isolation to deliver the full package of intervention for child and maternal nutrition.

In order to follow this holistic approach, real collaboration between government and CSOs must be functional, especially at district level, prior to starting any such initiative. Without the collaboration of strong leaders in

local government authorities and true dedication from NGOs, nutrition programmes become isolated interventions that will start and finish with the availability of donors and that will have very little impact or sustainability. Moreover, the sharing of goals, challenges and successes among stakeholders means that all interventions are inherited by the district and learning can be used for future interventions and solutions.

One of the characteristics of our model is the strong relationship with the LAs. This relationship is nourished by meetings, involvement in the capacity-building exercises, reciprocal help in terms of monitoring of the programmes and solving issues. The involvement of the LAs imparts sustainability to the interventions, enables projects to stay in line with the government's priorities and guidelines and facilitates the interaction between communities and district management by exchanging views on real situations at grass-roots level and implementing protocols at community level. Every district should not just welcome a single NGO's involvement but search for the full collaboration of all stakeholders in this type of relationship. The LA should also endeavour to reach small and minimally resourced CBOs/NGOs to allow everyone to reach the same level of knowledge and commitment.

Our approach is constantly updated by the continuous dialogue and work with communities in order to understand traditional beliefs, so that consequent interventions are relevant and respectful of the local culture. The same approach is used when networking with small NGOs/CBOs to recognise and address new challenges in nutrition, especially where cultural beliefs around food are concerned. A direct link with the community allows us to intimately understand the perceptions about malnutrition and to address those with greater insight.

Rainbow has been advocating for the creation of a district task force, which can coordinate the efforts, distinguish the roles, distribute the tasks and create intra- and inter-district nutrition protocols to guide new stakeholders into the interventions already decided and approved by the same task force. The leadership should come from dedicated district officials in charge of nutrition programmes and should include all stakeholders, such as line ministries, civil society and NGOs, that implement programmes or have a specific interest in nutrition and related issues. This innovative approach for Ndola District of networking and collaboration should be the tool used to guide new nutrition interventions, beyond personal or organisational interests to unify efforts and obtain successful outcomes.

In conclusion, our 15 years of experience with Rainbow suggests the following:

- Holistic approaches are needed to address malnutrition in Zambia. Everyone needs to work together towards a common goal and know their roles. Government and NGOs cannot do it on their own.
- The Rainbow model is an example of a Community-based Therapeutic Care model, one that has been running since 2008, confirming that the management of

malnutrition at community level must include different types of interventions: nutrition-specific or direct interventions (e.g. on-site feeding and food hand-outs), and nutrition-sensitive or indirect nutrition interventions (e.g. nutrition and health skills).

- The skills Rainbow demands from its leaders and workers are demanding: there are the harder skills from nutrition leaders – such as the ability to use M&E data and the foresight to design and commission impact studies – but also the softer skills: the willingness to

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build networks of relationships, to work with local authorities, to influence the creation of a district coordination task force, and the need to persuade health system leaders that the treatment and prevention of malnutrition must be embedded into health-care programmes.

- Finally, capacity-building development is a vital but often overlooked issue. Without strong frontline workers, nutrition specialists and good supervisors and managers, undernutrition will not be reduced quickly.

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Interventions and Approaches that are Proven to Work in Reducing Child Malnutrition in Zambia

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Abstract The Positive Deviance/Hearth (PDH) approach, addressing underweight children (6–36 months), was piloted and rolled out in four communities in Mwinilunga, Zambia. The objective was to improve child growth by applying locally identified positive feeding, hygiene, health-seeking and caring practices. PDH was implemented by trained community volunteers. Weights of participating children were monitored for the first year after Hearth. Changes in weight and nutritional status were analysed in three sites. Two of the three sites showed significant improvement in children's nutritional status and good graduation rates. Behaviour change on feeding (e.g. using taboo 'round' foods) and caring practices (e.g. involving men in childcare) were observed within sites. PDH has the potential to improve growth of young children in rural Zambia. Increased technical support, collaboration with the Ministry of Community Development, Mother and Child Health and other sectors, and supervision for community volunteers may enhance rehabilitation and adoption of positive local behaviours to reduce child malnutrition.

1 Introduction

Child malnutrition is widespread in Zambia, and is compounded by cultural food perceptions which limit children's access to nutritious foods. The Positive Deviance/Hearth (PDH) approach is a home and community-based nutrition programme for children, 6–36 months old, who are at risk of being moderately and severely underweight. The programme mobilises community members to use the 'positive deviance' approach to identify positive behaviours practised by the mothers or caretakers of well-nourished children from poor families and to transfer such positive practices to others in the community with malnourished children.

World Vision is a Christian relief and development organisation working for the wellbeing of all people, especially children. Through emergency relief, education, health care, economic development and promotion of justice, World Vision helps communities help themselves. Through its health interventions, the organisation has prioritised PDH interventions as one way of promoting child nutrition.

PDH has three goals that it seeks to address:

- 1 To quickly rehabilitate malnourished children identified in the community;
- 2 To enable families to sustain the rehabilitation of these children at home on their own; and
- 3 To prevent future malnutrition among all children born in the community by changing community norms in child care, feeding, hygiene and health-seeking practices.

This approach, which leverages local wisdom to improve child nutrition, was piloted in a village within Mwinilunga District in February, 2012 by the Ministry of Health (MOH), World Vision Zambia and community members.

PDH implementation has since been rolled out to four more communities. The objective was to improve child growth by applying locally identified positive feeding, hygiene, health-seeking and caring practices. This study examines PDH's effectiveness in: (1) changing behaviours and practices of participant caregivers; and (2) rehabilitating and sustaining rehabilitation of young children. Furthermore, it seeks to provide recommendations to strengthen the implementation of PDH in the five communities in Zambia.

2 Methods

PDH was implemented by trained community volunteers in the pilot community and rolled out to four other communities. A 'positive deviance inquiry' (PDI) was performed in each community to identify local practices that positively impact child nutritional status, including child feeding, hygiene, health-seeking, and caring practices (see Box 1 for an example). These practices were transferred to families of malnourished children through experiential learning during 12 days of 'Hearth' sessions.

Weights of the participant children were assessed on Days 1, 12 and 30 and three months after the start of Hearth, and compared to established PDH standards for weight gain. Additional follow-up points of six and 12 months after the start of Hearth were available for two communities. Other than on Days 1 and 12 of Hearth, all other time points were measured during monthly growth monitoring and promotion programmes coordinated by the MOH and community volunteers. Where monitoring points did not follow the standard timelines, the actual date recorded was used. *Data of non-participant children were not collected and included in the analyses.*

The PDH monitoring forms were collected from the community volunteers from the pilot site and two roll-out

Box 1 Six key Hearth messages developed during PDI of pilot site**1 Recommended foods for children**

- Three categories of food (body building, protective and energy-giving foods) – diverse meal (colourful: include red/orange, green and white);
- Give examples of foods for each category that is available in the community (emphasise importance of eating ‘round’ foods – see Section 3.1); must give children all these foods starting at six months (do not wait until child is circumcised);
- Foods do not affect the testicles and whether a girl will have a child easily or not, delayed menses and so forth (all traditional beliefs); do a body mapping to show that there is no relationship between where the food goes in and the testicles;
- Sweet potatoes, sweet potato leaves, cassava leaves, caterpillars, tomatoes, etc.

2 Feeding practices

- We should feed children frequently at the right time and not leave them hungry – three meals and two snacks (important to give snacks in between meals). If you take the children with you in the field, take snacks for them; if children stay at home, leave a snack or meal for them to eat
- Introduce solid foods starting at six months, but continue breastfeeding frequently for children up to two years of age;
- Important to supervise and encourage children up to two years of age as they eat (active feeding);
- Each child should have their own plate because older children eat faster than the younger ones and the younger ones don’t get their full portion.

3 Water and sanitation

- Wash hands with soap or ash before preparing and eating meals, after going to the toilet or changing nappies;
- Pour new water onto hand when hand washing instead of using one basin;
- Cover or close water in 20 litre storage containers (especially drinking water) or other water containers;
- Boil drinking water and/or add chlorine to treat water;
- Get water from borehole or protected well.

4 Hygiene

- Bathe children twice a day (once in day and once in evening) and wash clothes regularly;
- Each household should have a dish rack to dry their bowls and dishes;
- Wash bowls and dishes immediately after eating;
- Mother should also bathe at least once a day and wear clean clothes;
- Each home should have their own latrine and it should be well covered when not in use.

5 Caring

- Fathers need to be involved in caring for children (e.g. giving them food when they are hungry while mother is in the field or busy);
- Mother and father should have play time with their children (giving them attention);
- Take the younger children to the field with you and do not leave them with siblings unless they are at least 13 years of age.

6 Health-seeking

- When your child has a temperature, diarrhoea, and/or coughing, you should quickly take them to the health centre (do not wait);
- If your child is having diarrhoea and you have Oral Rehydration Salt (ORS) packets, feed your child the ORS;
- When a child is sick, breastfeed him or her more frequently and give more foods and fluids (do not stop giving food);
- Sleep under mosquito nets all the year round to avoid malaria.

sites. The pilot site started Hearth sessions in February 2012, the first roll-out site in March 2012 and the other one in May 2012. Furthermore, the first roll-out site had data for two Hearth sessions, but the two groups have been combined for the analyses. The monitoring forms of the other two roll-out sites were not available for analysis, as the communities were a part of another Area Development Programme within World Vision Zambia.

Due to variability of data quality and various start dates during the pilot and roll-out, the different Hearth sites were analysed separately. Wilcoxon Sign Rank Tests for

related samples were run to compare the weight-for-age z-score (WAZ) at Day 1 compared to five time points: Day 12, Day 30, three months after Hearth, six months after Hearth and 12 months after Hearth (the latter two points if applicable). Additional comparisons using the same test between time points were used to identify when significant improvements in WAZ occurred. All statistical analyses were performed with IBM SPSS Statistics (v.16).

Observations of Hearth sessions from the three sites as well as reports of community volunteers of PDH implementation were also reviewed to identify behaviour

Table 1 Graduation rates in three sites

	Day 12 graduation		Day 30 graduation		3 months' graduation	
	n	%	n	%	n	%
Pilot site	8	89	9	100	9	100
First roll-out site	6	46	4	36	1	9
Second roll-out site	5	56	8	89	8	89

Source Author's own from World Vision Zambia/Lunga Area Development Programme (2013) *Positive Deviance Hearth Database*.

change in participant caregivers in PDH and additional recommendations to strengthen the PDH programme.

3 Results

3.1 Behaviour changes in pilot site

Traditional food taboos to exclude fruits and vegetables considered 'round' in shape were modified by giving such foods to children as snacks during Hearth sessions. Using indigenous foods in Hearth meals and witnessing the improvements in energy level, mood and weight of their children changed caregivers' perceived value of these foods. After 16 months, 'round' foods were still utilised by families, though adoption of other behaviours was limited. Scarcity of recommended foods during dry season and frequent malaria and diarrhoea episodes were reported by caregivers as main reasons for growth faltering beyond the six-month follow-up in the pilot site.

3.2 Behaviour change in two roll-out sites

PDH promoted child immunisations for age, in requiring complete immunisations for age before commencing Hearth sessions. The collaboration formed through PDH with the MOH and the community helped to scale up immunisation coverage for the District Medical Office in areas where previously Child Health Days were not conducted. Monthly growth monitoring and promotion programmes were also initiated as they were absent before mobilising the community and the MOH.

Additionally, community members reported that PDH promoted male involvement in childcare through inviting male caregivers to participate in certain Hearth sessions and on graduation days.

In terms of weight gain, a child having an illness was frequently cited as a reason by caregivers for poor weight gain.

3.3 Graduation rates in PDH

The standard for graduation weight gain at 12 days for PDH is greater than or equal to 200g. Eight out of nine children (89 per cent) in the pilot site gained at least 200g (see Table 1). The child who only gained 100g was reported by the caregiver as having diarrhoea for the past few days. Six out of 13 children (46 per cent) gained the 12-day graduation weight in the first roll-out site. For the second roll-out site, five out of nine (56 per cent) children made the graduation weight gain. One child lost 500g and two children did not gain any weight; one child gained 5,200g and another 1,400g. This is not characteristic weight gain for children of this age, indicating inaccuracy with the weighing of children. Also, one child had a weight-for-age

z-score (WAZ) below -5, which calls for attention and a verification of the child's nutritional status.

The standard for graduation weight gain at 30 days for PDH is 400g or greater. All children in the pilot site made the graduation weight gain at 30 days. In the first roll-out site, four out of 11 children (36 per cent) made the graduation weight gain. In the second roll-out site, only one child out of nine did not make the graduation weight gain, so the graduation rate was 89 per cent. However, five of the children did not gain weight between Day 12 and Day 30 in the second roll-out site. This may be a clerical error during data entry and should be verified.

Usually at Day 30 with rates of graduation lower than 50 per cent, the first roll-out site would be re-evaluated and provided with extra supervision and refresher trainings for volunteers.

The standard weight gain for three months after Hearth is 900g or greater. All children in the pilot site made the graduation weight gain. In the first roll-out site, only one child out of 11 was recorded as weighing 900g, making the graduation rate 9 per cent. In the second roll-out site, as the monitoring took place four months after Hearth, the standard weight gain was adjusted to 1,150g. Only one child out of nine did not make the graduation weight gain cut-off, making the graduation rate 89 per cent. This child, however, was still growing well and had improved in nutritional status since Day 1 of Hearth.

3.4 Changes in nutritional status (WAZ)

In the pilot site, catch-up growth was evident at home up to six months after Hearth. All except one child had a better growth trajectory 16 months after the start of Hearth. Mean WAZ rose from -2.8 ± 0.2 to -2.0 ± 0.3 ($p=0.008$) within 30 days. Follow-up at three and six months showed improved mean WAZ compared to graduation on Day 30 (-1.6 ± 0.3 ($p=0.021$) and -0.7 ± 0.4 ($p=0.011$), respectively) with five out of nine children of normal nutritional status by six months. Mean WAZ declined to -2.1 ± 0.4 in the following ten months. Overall, the change in WAZ from Day 1 to 16 months after Hearth was 0.70 ± 0.6 ($p=0.015$).

There were no significant improvements in the first roll-out site from Day 1 to 12 months after Hearth. Looking at individual children in this site, there were five children who made steady progress over the 12–14 months. Thus, some families were able to promote catch-up growth in their children. The monitoring data also show, however, a steady decline in the number of children who were

followed up as the months passed (from n=17 on Day 1 to n=9 in 12 months).

The nutritional status of children in the second roll-out site (n=9) improved from -1.9 +/- 0.5 on Day 1 to -0.77 +/- 0.7 on Day 30 ($p < 0.008$) and even further to -0.0058 +/- 0.5 at four months ($p < 0.008$).

4 Discussion

The implementation of PDH in the three sites has yielded variable outcomes across the sites. The pilot site and the second roll-out site appear to have considerably better improvements in child growth than the first roll-out site in terms of graduation rates and WAZ changes. It is clear that more supervision and support for the volunteers was required for the first roll-out site. It may have been that two Hearth sessions were initiated within a week of each other, in agreement with World Vision Zambia and the community members and leaders. Thus, the quality of the implementation may have been compromised; but there is evidence of strong community support, as they were eager to conduct more than one session to admit more caregivers and children into the Hearth sessions. The other sites would have also benefited from technical support. For instance, in the pilot site, another PDI during the dry season may have helped to continue good growth in children, as well as another menu of recommend foods in the dry season. This may, however, require the support of food security or livelihood interventions to access nutritious foods for young children and families. As illnesses were commonly reported as a reason for poor weight gain, increased community outreach for management of childhood illnesses or projects improving water, sanitation and hygiene may prevent growth faltering.

In terms of behaviour change, PDH has been helpful to reduce traditional food taboos surrounding 'round' fruits and vegetables in the pilot site, and this behaviour was sustained as of the last monitoring point at 16 months. PDH has also facilitated changes in perceptions in the role of men and childcare. In the situational assessment of all three communities, men were not typically involved in, for example, the cooking of meals for the family. However, the PDIs from the communities revealed it was a positive practice for fathers to be involved in childcare. The measures to practise this behaviour during the Hearth

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sessions included inviting male caregivers to join the Hearth sessions and engage by helping weigh the children on graduation days. The changes in behaviour may have been adopted more easily as a result of the community discovery process through the PDI and reinforcement during the Hearth sessions.

The implementation of Hearth in the two roll-out communities has also increased health services in terms of immunisation and growth monitoring and promotion by initiating them in areas where they were previously non-existent. The stakeholder meetings with the District Medical Office and inclusion of local MOH staff in the PDH training of facilitators may be instrumental in the increase in health services in those areas.

A limitation of this study is that non-participant children and families were not examined, so both child growth improvements and changes in behaviour cannot be solely attributed to PDH. Further examination would show a clearer impact of PDH on participants and non-participants alike.

5 Conclusion

PDH is a culturally sensitive and effective way to change traditional perceptions on feeding and childcare practices, which have the potential to improve the growth of young children in rural Zambia. The sites examined show variability in how well PDH rehabilitates and sustains rehabilitation, though positive improvements in child growth are possible in the community. However, strengthened coordination with community stakeholders with regard to complementary interventions may improve outcomes and sustainability of the programme. Although community ownership of PDH is fundamental to the approach, adequate technical support and management of the programme is required, especially when addressing programme quality. Increased follow-up support and supervision for community volunteers, including appropriate assessment and action based on monitoring data, more than one PDI per community and refresher trainings on PD practices for different seasons and prevention of illnesses, may better sustain rehabilitation and enhance adoption of positive local behaviours. *Further study is necessary to elucidate the full impact of PDH on the families in the community.*

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The Role of Civil Society in Spotlighting Nutrition

William Chilufya, Marjolein Smit-Mwanamwenge and Eneyah Botoman Phiri

Abstract Implementation of nutrition interventions and agendas must be accompanied by a good understanding of nutrition among political players, policymakers and the general public. Civil society has a unique role of creating demand and building consciousness towards the importance of nutrition at all levels and among all key stakeholders in nutrition development. Awareness-raising and demand creation are key components of the story of change that has seen public involvement in an issue as important to development as nutrition. As a result, there has been meaningful involvement of the population, especially beneficiaries who are key in determining which interventions should receive most emphasis to bring about lasting improvements in nutrition status. A nutrition-conscious population will always seek for what is best in terms of nutrition, including holding to account duty bearers in the implementation process through effective monitoring mechanisms.

1 Introduction

‘Man is what he eats’ as coined by German philosopher Ludwig Andreas Von Feuerbach in 1864 is perhaps the oldest adage referencing the huge impact of food on our bodies. Apart from identity, food is the fuel that drives our activities and helps nurture our systems, while playing a pivotal role in our daily sustenance (King 2012). Above all else, food is the basis of nutrition and good nutrition is critical to the longevity and quality of life that one lives. Adequate quantity and consistency of nutrients has a huge impact on the growth and development of our physical and cognitive abilities (*ibid.*). A common misconception is that good nutrition only impacts our physical development in terms of how short, tall or weighty we are but studies show that nutrition has a direct impact on cognitive abilities as well (*ibid.*). Therefore, adequate dietary composition impacts the full life potential that comprises both the physical and cognitive development of an individual. In spite of this, however, it is an unfortunate reality to note that nutrition continues to have such a perennially low profile in Zambia.

2 Nutrition in Zambia

In Zambia, the prevalence of stunting is among the highest in the sub-Saharan region, with the latest figures for children under five showing stunting levels of 45 per cent, and 5 per cent being wasted and 15 per cent being underweight (GRZ 2009). Undernutrition, consisting of foetal growth restriction, stunting, wasting and deficiencies of vitamin A and zinc, along with sub-optimum breastfeeding, underlies about 45 per cent of under-five mortality (White 2008).

Following a period of steady economic development, Zambia is now classified as a lower middle-income country. However, Zambia is making insufficient progress towards achieving Millennium Development Goal 1 (te Lintelo *et al.* 2013). Zambia ranks 69th in the 2013 Global Hunger Index, and is facing an ‘alarming’ hunger and undernutrition situation (IFPRI 2013).

The Government of Zambia joined the Scaling Up Nutrition (SUN) movement in December 2010. It has also committed to improving food and nutrition security by signing the Compact for the Comprehensive Africa Agriculture Development Programme (CAADP) in January 2011. In April 2012, the government launched the National Food and Nutrition Strategic Plan and the First 1000 Most Critical Days Programme. However, budget analysis of the Zambia Civil Society Scaling Up Nutrition (CSO-SUN) Alliance showed that planned expenditure for nutrition interventions is lagging far behind the requisite spending per child under two for direct nutrition interventions as recommended by the World Bank (CSO-SUN Alliance 2013).

Zambia, much like other countries in sub-Saharan Africa with high levels of malnutrition, has poorly structured formal mechanisms to coordinate nutrition activities among the various stakeholders. Sectoral budgets for nutrition are fragmented and there is no national nutrition line budget (te Lintelo *et al.* 2013). Malnutrition is seen as everyone’s problem but no one’s responsibility, resulting in a failure to take effective collective action (*ibid.*).

At government level, there appears to be a reinforcement of the mono-diet system of feeding, if we examine government spending, particularly in relation to agriculture. Over the past two years (2012–13) the government has increased spending to the Food Reserve Agency (FRA) and Farmer Input Support Programme (FISP), two agencies primarily focused on maize production, by 53 per cent and 47 per cent in 2013, respectively (CSO-SUN Alliance 2013). This, while aimed at boosting the buyer capacity of farmers who supply the maize and the food storage, does little to diversify the diets of people. Nutritional focus has been mostly on avoiding nutritional deficiencies rather than understanding how nutrition in itself is a great preventative tool for fighting malnutrition in its many forms (Namugumya 2011).

One of the underlying causes of the low profile of nutrition at all levels in the country is a lack of knowledge on information about nutrition issues. At the grass-roots level, there is a need to create demand for information and services on nutrition. Citizens need access to information on nutrition interventions so that they can hold decision-makers accountable for their decisions. However, citizens often appear unconcerned about nutritional issues; there is little demand for knowledge about the health of the food we eat. Parents, especially mothers who are usually the decision-makers when it comes to what children eat, must be knowledgeable and aware of what they need to feed their growing children. It is alarming that this lack of knowledge on nutrition is also experienced by decision-makers. This has translated into weak political will to tackle the adverse effects of improper nutrition.

3 Zambia Civil Society Scaling Up Nutrition Alliance

Established in October 2012, the Zambia Civil Society Scaling Up Nutrition (CSO-SUN) Alliance is a movement of national civil society organisations (CSOs) working together to raise the profile of nutrition on the national development agenda, advocate for more funding towards nutrition and to increase the understanding of people on the consequences of undernutrition in early life, focusing on the most critical 1,000 days of a child's life from conception until the child's second birthday.

The 1,000 days is known as a window of opportunity as this is the most crucial period in a child's life through which malnutrition can be fought. Missing this window of opportunity could pose a risk to a child's mental and physical development and put them at a higher risk of being malnourished and being a victim of chronic diseases.

The Zambia Alliance is part of the global Scaling Up Nutrition (SUN) movement founded on the principle that all people have a right to food and good nutrition. It unites people from different sectors such as governments, the United Nations, donors, the private sector, civil society and researchers, all in an effort to scale up nutrition interventions. The Zambia Alliance is working towards a Zambia where every child is assured of sufficient nutrition through strengthened policy, financial commitment and adequate programme implementation.¹

Our goal is to increase coverage of effective and integrated nutrition programmes by ensuring political commitment to tackle undernutrition, increasing financial resources and ensuring accountability by government for nutrition. In order to achieve this, we aim to raise public awareness and national consensus about the problem and solutions of malnutrition through contributing to policy, legal and budgetary frameworks that address the needs of the poorest and most vulnerable. Furthermore, we wish to strengthen in-country accountability for progress in tackling undernutrition and, through networks, enhance learning between organisations and between countries and to maximise the effectiveness of their efforts.

Raising the profile of nutrition in Zambia requires the commitment of CSOs, political leaders and all other key decision-makers who are likely to be influential in

reducing the prevalence of malnutrition. This is being done through advocacy, so far most effectively through liaising with the media, conducting research and lobbying members of parliament.

4 The role of civil society in scaling up nutrition

The international momentum for action on nutrition recognised the need for strong leadership and the role of civil society in generating demand, securing political commitment and ensuring accountability for nutrition results. CSOs in Zambia are trying to raise awareness about nutrition but many of their efforts lack the necessary support from the general population, political players and policymakers because they have no direct experience and no personal understanding of nutrition issues. Hence the need to have a unified voice on issues of nutrition – the primary reason for establishing the Alliance. By collating the attitudes of various CSOs on nutrition and presenting them as one creates an enabling environment for nutrition.

An enabling environment can be defined as political and policy processes that build and sustain movement for the effective implementation of actions that reduce undernutrition (Gillespie *et al.* 2013). A review published in *The Lancet* series (2013) clearly shows that a political momentum can be developed and sustained through deliberate actions, but it needs the deliberate alignment of several factors and processes. The CSO-SUN Alliance plays an important role in creating and sustaining the momentum of improving nutrition through:

- (1) dissemination of evidence/awareness-raising;
- (2) advocacy – including communications and political mobilisation;
- (3) monitoring and evaluation/accountability; and
- (4) supporting government efforts, including mainstreaming nutrition across CSO programmes and complementing efforts/service delivery.

4.1 Dissemination of evidence/awareness-raising

The key roles and principles of civil society in the provision of knowledge and evidence is around global and national advocacy, framing and packaging of information to galvanise commitment, pushing nutrition up the development agenda and generating data showing the severity and distribution of malnutrition (Gillespie *et al.* 2013). The Zambia CSO-SUN Alliance has used various mechanisms to increase awareness of nutrition for the general public, but also has been advocating at national level to prioritise nutrition.

There is an overwhelming need to create national understanding of the problem of malnutrition in Zambia. For this reason, civil society has championed the campaign to raise awareness and create demand for knowledge on nutrition.

4.2 The ten 'asks'

In order to guide the advocacy strategy of the CSO-SUN Alliance, a list of ten recommendations was developed, designed to improve current plans and accelerate progress towards a Zambia where all children can see their rights to adequate nutrition, and full life potential, fulfilled, no matter where they were born or where they live (see Box 1).

Box 1 The ten key ‘asks’: key recommendations to guide advocacy of the CSO-SUN Alliance**1 Build political will to tackle undernutrition**

Studies on the governance of nutrition in different countries have highlighted the political will given to tackling malnutrition as one of the most critical factors for success in these efforts. Countries that have achieved more progress – such as Brazil and Peru, had high-level political champions clearly identified with the issue and pushing for progress, usually at the highest political level and for a sustained period of time.

2 Ensure effective high-level national coordination

Currently, the responsibility for coordinating efforts to tackle malnutrition in Zambia is assigned to the National Food and Nutrition Commission (NFNC), an organ of the Ministry of Health. However, despite its efforts, the NFNC has limited powers and capacities to convene and coordinate among the different actors who need to work together to ensure adequate progress in tackling undernutrition. Malnutrition is a multi-faceted problem, it requires coordinated action from multiple sectors of government, including the Ministry of Health (for treating those with acute malnutrition), the Ministry of Community Development, Mother and Child Health (for promoting healthy behaviours), the Ministry of Agriculture (for food security and production of nutritious foods), the Ministry of Local Government and Housing (for ensuring adequate water and sanitation services, to avoid frequent illnesses that reduce children’s abilities to absorb nutrients), not to mention the Ministry of Finance (to ensure adequate funding of nutrition programmes) and the Disaster Mitigation and Management Unit in the Vice President’s Office (to ensure planning for and mitigation of the impact of emergencies on food and nutritional security).

3 Increase spending to address the nutrition crisis

Government financial resource allocation to nutrition must increase. There is a need to look for innovative sources of financing to bridge the funding gap which would be in addition to aid from traditional bilateral and multilateral donors. It is important also that Zambia increases the domestic resources available to finance nutrition programmes.

4 Address the serious gaps to ensure adequate human resources at all levels

Zambia cannot realistically expect to address the crisis of undernutrition without urgently increasing the availability of qualified nutritionists. The crisis of malnutrition is complex. Addressing it requires technical competence across sectors. Zambia has limited numbers of trained nutritionists and dieticians to provide the necessary guidance in addressing the challenge, both at policy and programme levels (either for preventative or curative interventions). In health facilities, there are no trained dieticians or clinical nutritionists to guide the therapeutic management of conditions and diseases. Zambia’s critical deficit in nutrition human resources is highlighted in estimates of evidence provided by the University of Zambia (NFNC and CSO 2009).

5 Create transparent financial mechanisms to protect nutrition funding

Addressing the crisis of undernutrition in Zambia will require the allocation of sustained and significant resources over the long term. Zambia must find ample, innovative and (ultimately) Zambian sources of →

4.3 Nutrition champions

Using nutrition champions has proven to be essential in advancing the nutrition agenda in the context of fragmentation and competing interests between and within various groups of stakeholders (Gillespie *et al.* 2013). Nutrition advocacy champions, with both political and technical backgrounds, are needed at all levels to create effective political demand for better nutrition. Furthermore, there is a need to identify and work with legislative champions that are sufficiently knowledgeable, committed and capable of influencing policymaking to ensure a proper debate and consultation about new legislation, funding and organisational reforms (*ibid.*). This is one of the primary goals that the CSO-SUN Alliance is engaged in. The Alliance is working closely with a selected number of members of parliament (MPs), champions of nutrition, who have been trained in the importance of nutrition for development. The MPs have been advocating for more resources to be allocated to nutrition, for example during the budget estimate committees. It is proven that civil society engagement with high-level individual champions have raised the profile of nutrition in various policy forums in countries

like Peru and Brazil. Such champions are able to deliver advocacy messages on the impact of malnutrition in an easy and innovative manner that is understood by non-professionals.

4.4 Raising awareness through the media

The Alliance has used different mediums to raise awareness and understanding among citizens and policymakers, sharing information on the importance of nutrition and its impact on human and national development. Overall, engaging with the media has proved a highly successful tool in raising awareness. So far, the Alliance has published over 50 online and press articles. In addition to these, the Alliance has participated in many high-level radio and television discussions on national development matters that border on nutrition-sensitive and specific interventions. The Alliance has also collaborated to make a documentary on malnutrition called *The Silent Story* which can be viewed via YouTube. The Alliance is disseminating information to reach as many audiences as possible – from rural to urban areas. Communication tools employed include television shows, radio, online media, print media, traditional media,

Box 1 Ten key recommendations to guide advocacy of the CSO-SUN Alliance; the ten key 'asks' (cont.)

funding to address this critical issue, or child undernutrition will fall back into the scale of a national crisis, and all progress towards addressing it will be lost. The presence of alternative sources of funding from extractive industries or private sector investments has the potential to enhance the targeting and effective allocation of nutrition funding over the long term. In Zambia, the adoption of a 1 per cent medical levy suggests that there is potential for channelling tax revenue from mining companies to fund nutrition strategies in the long term.

6 Reform existing programmes to increase their effect on nutrition

In addressing the malnutrition crisis, it is important to realise the emphasis placed on the various sources of nutrients in the Zambian diet. The role of maize in the promotion of optimal health for the Zambian population is an area of contention. The 'agriculture policy' in relation to the 'maize debate' in Zambia has been pursued without due consideration to nutrition and development.

7 Provide clear public data and information on emerging evidence and strategy

Ensure data on progress made in tackling child malnutrition, funds spent (by province) and actions that will be taken to address future problems is made available publicly. Frequent data observations on nutrition outcomes to monitor progress are preferable to the development of detailed nutrition indicators.

8 Ensure effective decentralised coordination at provincial and district level

Delivering nutrition services at the local level tends to work better in countries that have adequate decentralised structures. Some factors that facilitate service delivery include donor or government capacity to provide technical support at all levels and the availability of reliable nutrition data and performance indicators. Effective decentralised structures can also contribute to improved capacity of government offices at the provincial and local levels through training programmes, as well as professional incentives and salary rewards.

9 Provide financial incentives to engage the private sector to tackle undernutrition

A number of items are currently exempt or zero-rated under the value-added tax (VAT) scheme. We support this policy and we further urge government to exempt or zero-rate nutritious food (a range of products that could be used to prevent stunting) traditionally purchased by poor individuals, especially poor women. To that end, it is fair for government to give incentives to companies producing highly nutritious foods so that they are more affordable to the poor communities.

10 Engage civil society as a partner in the fight against undernutrition

Civil society has the potential to make malnutrition problems visible and improve the scope and quality of service delivery through research and advocacy. Civil society groups have actively campaigned on nutrition issues in Brazil and India. In Brazil, however, CSOs have influenced and shaped nutrition policies more effectively because they directly engage with political parties, government ministers and local governments, to turn nutrition campaigns into government policies.

meetings and events, social media (Facebook, Twitter), phone-in contests and competitions (Maseko 2013).

In Zambia, radio has extremely wide coverage compared to any other form of communication and is a lot more accessible to the majority of the population. Interactive phone-in programmes are being used to help to raise the profile of nutrition as they are one of the best ways to engage the listener: learning becomes easier when people are given the freedom to ask questions about things they do not understand then hearing the answers immediately.

Pre-recorded programmes are being used to complement live phone-in programmes. The Alliance encourages radio stations to re-broadcast programmes on nutrition, particularly those that involve expert discussions. For rural communities that do not receive a radio signal from the national broadcaster, community radio is being used to reach such areas to ensure that no one is excluded.

Television is also essential for raising the profile of nutrition. Talk shows with influential political leaders as guests focusing on nutritional issues have been aired to

help people to understand the underlying causes of malnutrition. Television has been used to show the impact of undernutrition and has consequently educated its audience. In the same way, articles in newspapers are used to target people who gather their information by reading.

4.5 Nutrition awards

In 2013, the first nutrition awards went to the Vice President and the First Lady of Zambia for their efforts to improve nutrition. MPs who have been actively engaged with the CSO-SUN Alliance and have lobbied at parliament for the prioritisation of nutrition, and NGOs and CBOs which are active in the field of nutrition were also awarded. Media houses and journalists who had good coverage of nutrition-related news and articles also received awards in recognition of their efforts in raising awareness on nutrition and as a motivation to continue their good work.

4.6 Political economy of stakeholders, ideas and interests

An important role of civil society is to keep government and other stakeholders accountable for coverage, quality and equity of actions to reduce undernutrition and to

contribute to multi-stakeholder platforms for decision-making, in-country support to the SUN movement, but also to strengthen the voice of communities, women and children (Gillespie *et al.* 2013).

4.7 Budget tracking and analysis

Another way in which the Alliance embarks on influencing policy is through budget tracking and analysis. The Alliance provided training on budget tracking at both national and district levels to CBOs, NGOs and local government in order to increase capacity to hold the government accountable for the expenditure on nutrition as planned. Budget tracking and analysis is done by analysing the official budget document of the Republic of Zambia (national and district level) and using the analysis as an advocacy tool to lobby for more investment in nutrition within the five key line ministries. This process helps in giving direction on how much the government is spending on nutrition-related interventions and to track whether it is keeping to its commitments. The national budget analysis showed that although there are various budget lines dedicated to nutrition within the various line ministries, the level of funding for both nutrition-specific and nutrition-sensitive interventions is very low. Based on budget lines which are clearly linked to nutrition, the government will spend a total of only 3 kwacha on nutrition interventions per child under the age of two years. This is far below the government's commitment and World Bank-recommended spending of 170 kwacha (approx. US\$30) per child under two years old (CSO-SUN Alliance 2013).

The findings of the national budget analysis were presented to the Parliamentary Expanded Committee on estimates and are used as an advocacy tool to increase spending in nutrition.

4.8 Raising awareness through creating synergies

The Alliance is also playing a key role in raising the profile of nutrition within Zambia's political leadership and ensuring that national plans and strategies include nutrition priorities. They have been making deliberate moves to invite key political leaders to nutrition-related events, meeting and workshops.

Held by the Alliance, the Nutrition Champions Meeting on 1 May 2013 greatly increased political commitment, as it involved MPs. Its aim was to improve their knowledge on nutrition issues in order to accelerate nutrition development on the long-standing poor state of nutrition among children.²

4.9 In-country support to the SUN movement

The CSO-SUN Alliance and its members provide support and technical assistance to the SUN programme/First 1000 Most Critical Days Programme implemented by the government. The Alliance works closely with its members at national level and also at district level, supporting the development and implementation of the district nutrition multi-sectoral plans, which are part of the First 1000 Most Critical Days Programme.

4.10 Strengthening the voice of communities, women and children by working at district level

The CSO-SUN Alliance is working in three districts in Zambia where the government will implement the First

1000 Most Critical Days Programme: Mumbwa, Lundazi and Samfya. The main objective is to increase awareness about nutrition and utilise existing groups – such as women's groups, nutrition groups, farmers' associations and neighbouring health committees – for local advocacy at district level. These groups have received training in budget tracking in order to hold local government accountable for the implementation of the First 1000 Most Critical Days Programme.

4.11 Capacity (individual, organisational, systemic) and financial resources

Gillespie *et al.* (2013) describes the role of civil society in the domain of capacity building as the ability to raise financial resources through effective public campaigning and to increase capacity to deliver services and reach marginalised communities.

4.12 Capacity building

Because the CSO-SUN Alliance realised that the levels of understanding about malnutrition among MPs, CSOs and media are low, it has provided training sessions to better understand the multi-sectoral causes of malnutrition, its consequences for human development and the First 1000 Most Critical Days Programme. Trainings were also provided at district level for the CSOs.

4.13 Raising financial resources

The Government of Zambia has pledged during the Nutrition for Growth Summit to increase the nutrition budget by 25 per cent. This is in part due to successful lobbying by the Alliance and other stakeholders.

5 Conclusion

Although important steps have been made in increasing awareness of nutrition among policymakers, there is a need for increased efforts by Zambia's political leaders to ensure that nutritional interventions are well funded. The 2014 budget analysis shows that the amount of money budgeted for nutrition-specific and sensitive interventions is inadequate by far to bring about change in the prevalence of stunting in Zambia.

CSOs have an important role to play in ensuring that nutrition is considered as high priority in political and development agendas. There is need for collaborative work among different government agencies, civil societies, development partners and the private sector which has a great potential but is usually ignored. Nutrition policy agendas cannot be properly funded if nutrition is only seen as an output and not as an input to growth and development (Meerman 2008). Therefore, the CSO-SUN Alliance will continue to build commitment of policymakers and to encourage them to prioritise nutrition in order to accelerate progress in improving the nutritional status of children and their mothers in Zambia.

6 Lessons learnt

Many lessons have been learnt from being part of the global SUN civil society network (SUN CSN). These include:

- a Easy access to shared information especially from the global civil society SUN secretariat. The global SUN CSN has enabled the sharing of information between

and among countries, which includes pairing member countries. For instance, we have been paired with Malawi to facilitate cross-learning, especially as we are neighbouring countries facing similar challenges.

- b Since the SUN movement has adopted a multi-sectoral and multi-stakeholder approach to nutrition issues it has been easier for civil society networks to penetrate government departments and sectors, the cooperating partners, the media, MPs and the private sector, among others, thereby making it easier to achieve advocacy objectives.

Notes

- 1 Scaling Up Nutrition (SUN) <http://scalingupnutrition.org/about> (accessed 15 November 2013).

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- c Membership to SUN CSN is also cardinal for having a unified voice in delivering the advocacy message. The chances of influencing policy are much higher with such an international backing.
- d Furthermore, belonging to SUN CSN assists in the alignment of our strategies, programmes and resources with Zambia's plans for scaling up nutrition. This has helped the Alliance to continue to be relevant around issues of Scaling Up Nutrition.

- 2 *Daily Nation*, 'Under-5 Deaths Shocker', <http://zambiadailyNation.com/2013/05/02/zambias-under-5deaths-shocker/> (accessed 20 November 2013).

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Intersectoral Coordination for Nutrition in Zambia

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Abstract The underlying determinants of nutritional status are adequate food, health and care; the goods and services related to these will necessarily be available from a range of sectors, provided in a coordinated fashion for maximum effect. Despite this recognition, there is currently little evidence of coordination between nutrition-relevant sectors in Zambia. In Mumbwa District, a facilitated process is underway to coordinate ministries and NGOs involved in the provision of nutrition-related services. The creation of a District Nutrition Coordination Committee (DNCC) has been useful, and sustained facilitation has built trust and mutually supportive learning between diverse stakeholders. While recognising that it will take time for fully effective and implementable solutions to emerge, the DNCC is a potentially durable and effective way of addressing undernutrition over the long term. This article describes some of the theories, processes, challenges and learning from the first two years of the DNCC in Mumbwa.

1 Introduction

It has long been recognised that the key underlying determinants of nutritional status can be summarised as ‘food, health and care’ and that the public goods and services relating to their provision will necessarily come from a range of sectors – in particular agriculture and health – preferably provided in a coordinated fashion for maximum effect (UNICEF 1990; Ruel *et al.* 2013; Garrett 2008; Gillespie, Harris and Kadiyala 2012). The nutrition community, however, has not yet overcome the political and institutional challenges to fostering the coordination necessary for efficient delivery of these key elements. There is no consensus on how intersectoral solutions are best implemented or institutionalised, and there is a clear lack of evidence on how to facilitate and sustain these, particularly at the local level, where implementation actually occurs (Harris and Drimie 2012).

Based on this premise, a key question is how can such an integrated approach be implemented in practice? Some interesting and important evidence is beginning to emerge, in particular in Zambia. In response to this societal problem of undernutrition, specifically child stunting, a somewhat unique collaborative innovation has become evident which involves different sectors across government, civil society and advocacy groups coming together to learn and act in new ways. This collaboration involves the application of international thinking in a local context with tentative links to communities. It is a coordinated innovation that cuts across different levels, scales and sectors, which provides an important case study of co-innovation to address the complex and ‘wicked’ problem of stunting. This is explored below.

2 Challenges facing alignment and coordination

A key dilemma emerging from the nutrition literature is that although many of the solutions to malnutrition are relatively well known and understood, its complex and

multisectoral nature has made coordinated implementation across sectors difficult (Benson 2007, 2008). Although mutual gains can be made for different sectors, particularly agriculture and health, it has been a challenge to work together in a variety of contexts (Garrett 2008; Garrett and Natalicchio 2011). Previous experiences suggest three broad barriers to intersectoral collaboration for nutrition: (1) low political commitment and space for new ways of working; (2) existing routines and structures within sectors, not least of authority, finance and information, and weak coordinating bodies; and (3) lack of human resources and capacity, in strategic and management skills as well as technical (Harris and Drimie 2012).

In terms of the way government is structured, and the subsequent sector-specific resource flows and evaluation and incentive arrangements, there are good reasons for the sectoral structure of government. But this in turn shapes political space for working on different issues, and does have the unfortunate effect of not being sufficiently flexible to effectively address complex problems that do not fit neatly into the structure, with nutrition being one such issue (Benson 2011). The top-down nature of planning and financing processes in most government structures brings up issues around over-centralisation, and fragmentation into silo structures (Drimie and Ruysenaar 2010). An important dimension of this is that attempts to bring various government departments or ministries to work closely together must be seen in a financial context where the fiscal control and oversight of the Central State or National Treasury have to be adhered to. These arrangements do not easily allow for a ‘blurring of funds’ or alignment of plans for joint projects. In reflecting on this issue in the South African context, a former cabinet minister, Kader Asmal, argued that, ‘unless budget is allocated to the clusters – which it isn’t – then it can’t be “joined-up” decision-making’ and therefore ‘joined-up’

government for tackling cross-sector issues was an elusive reality (Calland 2007).

Low technical and management capacity and understaffing can be major causes of institutional stress and poor outcomes. The lack of human resources and capacity for nutrition programming has been found to constrain the implementation of even the most strategic and well-resourced programmes (Swart, Sanders and McLachlan 2008). Staff at the local level often do not possess the knowledge and skills needed to design and implement adequate interventions in various sectors, and often do not receive adequate national-level guidance. In reflecting on nutrition programming in South Africa, McLachlan and Garrett argued that ‘more of the same is not enough’ and suggested that capacity development must go beyond improved technical capacity, with less tangible skills for cross-sector working being in some cases more vital (2008). Of particular importance is the culture of public officials looking towards moving onwards and upwards in terms of their careers, which encourages an attitude of ‘facing upwards’ towards the next job prospect, rather than ‘facing downwards’ towards the ‘people on the ground’ (or indeed ‘outward’ to other sectors). Further, there is often a high turnover of incumbents, and a significant number move out of the agency or department where they are located, making it difficult to create a stable body of expertise in the functioning of a specific government structure (von Holdt *et al.* 2011). These issues have not been addressed by ‘business as usual’, and different ways of thinking and working are therefore needed.

3 The Mumbwa District Nutrition Coordinating Committee

According to the most recent Zambia Demographic and Health Survey, the national prevalence of stunting among children under five years of age is 45 per cent; this has remained little changed since the previous national survey (CSO *et al.* 2009). In response to these very high rates of child stunting, an intersectoral process has been initiated by the international non-governmental organisation (NGO), Concern Worldwide, to bring together relevant ministries and civil society organisations in one district, Mumbwa, under a coordination committee aiming to improve understanding and align activities for nutrition at local level.

This has been a unique process despite the increasing recognition at national level in Zambia of the importance of addressing stunting. Since at least 2009, Concern Worldwide, working in close collaboration with the International Food Policy Research Institute (IFPRI), has been intent on developing a cross-sectoral implementation model that reduces malnutrition in young children by combining agricultural interventions with nutrition and health activities. After a wide-ranging scoping phase, Zambia was selected partly because national level institutions such as the National Food and Nutrition Commission (NFNC) indicated an interest in such a process. Similar to many other countries, the NFNC lacked the political leverage to facilitate an intersectoral process to effectively compel representatives of different sectors to work together. This was largely because of its position under the Ministry of Health with its predisposition to addressing malnutrition through health

initiatives. This situation reflects the low relative power of the NFNC, as they have been unable to persuade a political leadership to assign nutrition as a priority despite its existence since 1968. It also reflects an entrenched structural issue as nutrition has been assigned to a ministry with a very specific mandate that is much narrower than what is required to address malnutrition. Concern Worldwide’s initiative therefore provided an opportunity to see what was possible at a local level.

As such, with Concern Worldwide’s initial facilitation, the Mumbwa District Nutrition Coordinating Committee (DNCC) was established by the district commissioner and includes district representatives from the ministries of Agriculture and Livestock (MAL), Health (MoH), and Community Development, Mother and Child Health (MCDMCH), as well as other ministries and civil society organisations working on nutrition in the district. The DNCC is officially recognised under the District Development Coordinating Committee (DDCC), an existing district body, and reports to it, and through that mechanism to the district council and provincial and national bodies. In addition, the DNCC has so far established four ward-level committees within the district to enable joint planning and implementation of activities close to communities.

The purpose of the DNCC has been to establish district-level institutional arrangements to realign and coordinate the activities of different actors to effectively address the intertwined causes of child stunting. To do this, the committee has set out to build on the strengths of existing actors, systems and capacities to facilitate a shift in how stunting is understood and addressed. The result of this process would be coordinated strategies and joint interventions for stunting prevention. Ultimately, the DNCC aims to demonstrate that intersectoral coordination and alignment, bringing in health, agriculture and other key sectors, is a viable and effective approach to address stunting, and to provide a practical example of how this can be achieved, sustained and replicated elsewhere in Zambia. If the DNCC could demonstrate how it had brought different sectors together in practical ways, then this would be a clear indication of success.

4 Underlying framework: learning and doing

At the outset of the project, it was recognised by Concern Worldwide as convenors of the process that the very nature of stunting would defy attempts to address it by simply combining approaches. Malnutrition, and in particular stunting, can be described as exhibiting many elements of a ‘complex social challenge’, which requires different ways of understanding and responding than have previously been employed (McLachlan and Garrett 2008): under-nutrition is *socially complex* because there are many players required to address it and many perspectives about how to do so. This is abundantly clear in the nutrition literature (Bhutta *et al.* 2008, 2013). The people involved see things differently, so perspectives become polarised and resolutions are not easily found. Stunting is also *dynamically complex* because people have difficulty grasping the consequences of not dealing with it as the causes and effects are often intangible in space or time. Addressing stunting is *generatively complex*, as its causes and

consequences are unfolding in unfamiliar and unpredictable ways. Therefore a first step to dealing with stunting is to acknowledge its complexity.

As such, the convenors agreed that a process would be facilitated to develop social innovation among key partners. This process was strongly informed by Theory U, which promotes a creative, learning approach that moves from changing the perceptions of participating actors, through experiential learning and sharing, to transforming their own sense of responsibility for change through dialogue and reflection, to ultimately acting on this (McLachlan and Garrett 2008; Senge *et al.* 2004). This approach has been used with success in the Southern Africa Food Lab, which was initiated to engage the similarly complex question of food insecurity in South Africa (SAFL and PLAAS 2013). In practice, applying Theory U has involved bringing together relevant actors in Mumbwa to share, understand and learn from their diverse perceptions of stunting. This process has meant deepened conversations and shared promises within a carefully selected group who have committed to addressing the issue. As the DNCC meets and learns more about malnutrition in the district through facilitated field visits, workshops and dialogue, the intention has been for creative and mutually supportive thinking and learning to emerge. Ultimately it is envisaged that the strengthened capacity, confidence and commitment of the actors involved in the committee would translate into the design and implementation of innovative solutions to help address stunting.

This process is therefore different in nature to other intersectoral committees that may have been established in the past. Intersectoral committees had been established before, for example to address HIV and AIDS. The intention here, however, was generally to convince actors of the need for all sectors to address HIV and AIDS and to coordinate sectors in the fight against the epidemic, rather than shifting the deep understanding and resultant action of the actors in meaningful ways. The intention of the DNCC, however, has been ultimately to initiate innovation. Three kinds of innovation are possible for realising change in the interests of addressing stunting in Mumbwa: the formation of new relationships; the development of new insights; and the generation of new commitment, vigour or energy to take risks to do something different. Out of these, new and creative actions are more likely to grow. The argument essentially pivots on the notion that individual change evident through new relationships, insights and commitment will translate into institutional change, which can ultimately lead to system change – necessary to nurture and sustain new ways of working.

Although establishing a committee that meets to share and learn may appear relatively simple, it has involved careful engagement with the political and bureaucratic power in the district. This is because officials report directly to line managers within ministries according to agreed upon and budgeted development priorities. Stepping away from this may have caused tensions without the support of the most senior official in the district, the district commissioner, who agreed to (symbolically) chair the DNCC. Similarly, the DNCC has received recognition

from the District Development Coordinating Committee (DDCC) as part of its structure and is required to report on activities quarterly. Having secured this political space, the DNCC could begin its learning process with the intent of translating this into new ways of working that would ultimately address stunting. This reflects an important lesson from the nutrition literature that the alignment of interests around nutrition improvement would inevitably need to be achieved through negotiation, contestation and settlement (Nisbett *et al.* forthcoming).

5 The experience of the DNCC

What then has been the experience of the DNCC with these broader issues in mind? When the committee was established in February 2012, after careful consultation with all the relevant stakeholders in Mumbwa, the agreed intention was to develop a model for sectoral integration for tackling undernutrition. As noted above, an early success was the rapid integration of the DNCC into the existing bureaucratic system; the DNCC was mandated by the politically appointed district commissioner, chaired by the most senior district official in the Ministry of Health, populated by officials from ministries and organisations with potential impacts on malnutrition, and constituted as a member of the DDCC. Creating a new structure is relatively straightforward; creating and sustaining a structure that effectively aligns and coordinates activities to address undernutrition is, however, somewhat different. Although it is too early to ascertain any effective impact on the ground, some key lessons have emerged around the process, which are discussed below.

5.1 Experiential learning and sharing

An important aspect of the coordination process has been the acceptance of the DNCC meetings as a space for learning and sharing, that part of the ‘business of the DNCC’ has been to learn and reflect, and that multiple perspectives are something of value. The process that has unfolded has not been led by preconceived solutions to addressing undernutrition but rather an approach that has developed incrementally, with inputs including prior evidence of what works and the perspectives of different parties involved, allowing real learning and a growing understanding of stunting among those involved in the DNCC. In this way, a common understanding about stunting and responses has emerged; although sector-specific views still pervade proceedings, actors have come to see stunting from several of these different perspectives.

This was exemplified when the DNCC developed both a ‘problem tree’ analysis of stunting in Mumbwa, as seen from a multisectoral perspective, as well as a ‘solution tree’ to guide responses, a potentially useful tool for fostering multisectoral understanding of an issue. The problem tree was created by first developing sector-specific analyses of the causes and consequences of stunting and then integrating these as a group. The exercise revealed a number of overlapping themes that enabled the DNCC to identify areas of possible collaboration. Having reviewed and agreed this analysis, the DNCC embarked upon a learning journey to a village two hours by road from Mumbwa town. A learning journey is a way of exposing a group of people who are united in their interest in a particular issue but diverse in their

positions and perspectives on that issue to the current realities, experiences and stories of people most directly affected by that issue. This exposure is an entry point into a deeper understanding of these realities and into a deeper engagement with one another about how to address these realities. Towards the end of the exercise, the DNCC engaged with a large group of community members in a village meeting space and a report-back exercise pivoting on the problem tree analysis was undertaken. After an animated exchange, the community and the DNCC adjusted the tree to reflect important changes including an emphasis on power relations, particularly that between men and women; inadequate government presence in terms of agricultural extension support; and the centrality of cultural norms that limited access to some nutritious foods. In this way it was recognised that the perspectives of officials should be tempered with the realities of people most affected by stunting. It also raised the issue of 'power in the system', which is explored in Section 5.2.

5.2 *Advocating upwards*

Despite some favourable structures and policies at the national level, particularly through a new nutrition policy and strategic plan and a resurgent emphasis on nutrition through the emerging Scaling Up Nutrition (SUN) movement,¹ there is currently little coordination between the sectors on nutrition in Zambia (Harris and Drimie 2012). The country is not alone in having difficulty with bringing action to its plans; many countries in Africa and beyond are struggling with similar issues. However, with the high-level momentum created by SUN, the NFNC as the national steering body for nutrition is in an opportune position to become a force for nutrition advocacy, planning and implementation. There are hopes from organisations such as the World Bank and other international donors that the NFNC will assume the important role of facilitating intersectoral dialogue and advocating for increased resourcing towards nutrition.

Having acknowledged this as a potential opportunity, the DNCC prioritised a national level forum whereby the emerging experiences from Mumbwa could be shared. Apart from distributing the early lessons, it was hoped that such an interaction would galvanise support from national level institutions, including line ministries. This national event in October 2012, facilitated by Concern Worldwide with support from the DNCC, was carefully choreographed with the NFNC chairing the meeting and included speeches by the permanent secretary of the Ministry of Agriculture and Livestock, and the district commissioner of Mumbwa. In this way the experiences of the Mumbwa DNCC were given an important political opportunity. By engaging national level structures, the DNCC was in a position to generate lessons at a local level to contribute to national and international learning, including feeding into SUN.

Although the direct impact of the meeting is difficult to measure, it is likely that the exposure led to the NFNC and its donor partners identifying the DNCC as a possible model for coordination on nutrition in the future. The NFNC visited key ministries and NGOs in Mumbwa in mid-2013 to conduct a nutrition situation gap analysis,

which resulted in the drafting of a Nutrition District Plan with one key objective being the inclusion of 'support for promoting multi-sectoral coordination on nutrition, through a to-be-established District Nutrition Coordinating Committee under the DDCC' which would provide 'robust stewardship, harmonization and coordination' (SUN 2012). Taking the DNCC as a model, the NFNC intends to replicate the committees in a similar vein to ensure a coordinated response to stunting at a local level, initially in 14 pilot districts (including Mumbwa). The SUN focal point within NFNC later informed the DNCC that their structure had influenced much of the thinking behind the roll-out of SUN across the selected pilot districts. Clearly the model was eliciting interest and being taken seriously as nutrition became a more prominent feature in the broader political economy of Zambia.

5.3 *Innovations*

The three kinds of innovation that might create new possibilities for addressing undernutrition (new relationships, new insights and new commitment) can only be truly effective if new and creative actions arise. When reflecting on their achievements after almost two years of existence, members of the DNCC argued that the establishment of the committee itself was an innovation, particularly that it was unique in Zambia.² Other innovation has emerged from the DNCC. There is, for example, a clear commitment to working together, to sharing ideas and information, to keeping each other informed, and to attending meetings. These issues cannot be taken for granted, as numerous disincentives exist within government structures to avoid 'blurring the boundaries' between line ministries and working outside of core ministerial mandate. Another innovation is an energetic attempt to recognise and include new stakeholders in the district that may have a bearing on addressing undernutrition. Part of this innovation is that it transcends not only government sectors but crosses civil society and the state, with emerging attempts to bring in grass-roots community-based organisations. An example of this was the recognition that women's land rights, or the lack of them, had a direct impact on undernutrition; the DNCC therefore resolved to bring in the Ministry of Lands to join the committee, certainly a non-traditional partner for nutrition. The DNCC had become a forum where members from different sectors could address problems articulated by others they did not normally engage with in routine activities.

An example of the impact of sharing information has been the DNCC's decision to institute ward-level committees to develop plans that could be funded by a community development budget within the Ministry of Health. Without the DNCC, this fund would have remained largely untapped and certainly unknown to other ministries and NGOs. Thus at community level, the DNCC has constituted four ward-level versions of itself (Ward Nutrition Coordinating Committees, WNCCs). Each WNCC has been invited to submit plans for activities and has been supported by a sub-group of the DNCC to develop these with appropriate budgets within the stipulated framework of the ministry. Similarly, the establishment of the WNCC has allegedly enabled government extension workers, other organisations and

the community itself to talk about nutrition in their community, although the quality and depth of these discussions is so far uncertain.

One tangible example of activities to come out of the DNCC has been the sharing of vehicles, fuel and staff for cooking demonstrations, which each ministry was undertaking separately and are now combining. While seemingly small, it is the very real everyday issues such as resources to get out to communities that often hamper activities. These are all important examples of how the DNCC has enabled its members to work differently in attempting to address undernutrition. However, they are also initiatives that have taken over a year to realise, raising a question of priorities, leadership and commitment within the DNCC.

Despite these achievements, the DNCC has acknowledged that the formation of a committee is not enough to automatically lead to solutions to undernutrition. This reflects a view that although much had been achieved since February 2012, the DNCC has had little to show in terms of actual alignment and coordination to affect change on the ground. Although this may appear a stark judgement after so much effort, it should be remembered that the issue of undernutrition is socially, dynamically and generatively complex and that it will take time for effective and implementable solutions to emerge. This process is not a 'quick win', but rather a potentially durable and effective way of addressing undernutrition over the long term; the process is ongoing, and is generating learning as it goes.

6 Learning from Mumbwa

It is clear that a big challenge facing the implementation of nutrition policy in Zambia is the absence of any effective coordination mechanism that aligns different responses across sectors. This has been compounded by existing structures giving a lack of real power or authority to work differently at a local level. A key question, therefore, is how to elevate the issue of coordination and alignment to address undernutrition in the list of complex issues facing government. Part of the answer may lie with the emergent SUN, while another lies with securing high-level champions within the key line ministries such as health and agriculture to provide the space and compulsion for attempting change. Another potentially important process expected to continue over the coming months and years is decentralisation of some spheres of government, with some on the DNCC hopeful that this might open up a space for innovation at a local level.

Within these systems and structures, attention to the individuals involved is critical. Intersectoral partnerships of this nature require patience and persistence, but, when managed well, can build the cross-sector stability needed to address challenges such as undernutrition. Any attempt to initiate, implement or facilitate such cooperation processes is an intervention into a fragile and often controversial system of actors. So, it requires careful attention to the quality of the process, the quality of relationships, and interaction among stakeholders; although the approach underpinning Theory U is both intuitively appealing and supported by evidence of impact, the realities confronting diverse actors in working in an aligned and

coordinated way are striking. Continuous reflection and opportunities to 'retreat' from DNCC activities are necessary components of this process; this then affirms the ongoing strategy to deepen conversations to build commitment and ultimately create and drive innovative responses to the complex nutrition problem. It also, however, reveals a gap in the strategy, in that higher-level power is required to ensure that the plans and ideas to work together in new ways are actually translated into action.

The qualities of the structures and relationships that have been created to make the cooperation work are crucial. Structures such as the DNCC require individuals to lead them; they also require individuals to trust each other, which requires putting a particular emphasis on building and maintaining relationships between the different actors involved in the cooperation process. In turn, individuals undertaking this process require structures and support to enable emerging leaders to effectively guide the process, and to allow different actors to follow the process. Without concerted support and commitment of an external agent – Concern Worldwide – from the outset, it is not clear whether so much progress would have been made with the DNCC in the absence of this support from line ministries or national level institutions.

Simultaneous attention to both formal structures and the support of individual agency is therefore vital in formulating a functioning coordination committee with space for innovation in working. There is a possibility that the roll-out of new committees in pilot districts could be a replication of a technical structure within existing systems based on the DNCC experience, rather than a process with emphasis on the mechanisms of learning and understanding for actors within such a structure that would enable real alignment and coordination that would ultimately lead to the innovations to address undernutrition. As these committees are replicated under SUN, both the structures and the underlying mechanisms by which the committee has proceeded deserve attention. In addition, the role of convening and facilitating by an entity or individual outside of the line ministries will be a necessary part of the structure if such an intensive process that the DNCC has experienced cannot also be replicated. These will be key points to address in attempts to scale up intersectoral coordination for nutrition in Zambia.

7 Concluding comment

The process of creating and sustaining an intersectoral committee is a slow and at times difficult one, but this article has presented several tools and ideas for future similar processes, and several insights from the current process. In reflection, the DNCC has become a space for intersectoral dialogue and communication, and the first important steps towards local coordination across sectors have been taken. Representatives of sectors have been able to share and understand what each are doing to address malnutrition in Mumbwa, and place this in the context of a 'sea-change' in nutrition in Zambia more generally: SUN has begun to mobilise increased investments in nutrition, and started to change the discourse around nutrition in Zambia, a move towards creating the political space for undernutrition to be addressed. The DNCC believes that within this changing

landscape, it has been innovative in responding to the issue of undernutrition, particularly in terms of establishing an entity that is committed to meet regularly and that is characterised by genuine sharing and learning. They have, however, also acknowledged that this is not enough to substantially address the issue, and that commitment would have to be elevated and innovation allowed by existing structures for real change to occur.

Notes

1 Zambia signed up to the Scaling Up Nutrition (SUN) movement in 2010, and this has begun to strengthen over the past year. SUN aims to guide national action on nutrition by providing a framework of key considerations, principles and priorities for action to address undernutrition with a particular focus on the

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Both of these critical issues may be partly addressed by SUN, which is bringing attention to the issue and promoting the implementation of the emerging prototype DNCC as a priority. As attempts at coordination for nutrition continue within the DNCC in Mumbwa, much is still to be learnt from a process that is actively engaging the reality of addressing undernutrition in new and important ways.

- '1,000-day window of opportunity' for malnutrition reduction between conception and two years of age.
- 2 District Nutrition Coordinating Committee (DNCC) (2013): minutes from a capacity-building workshop, Lusaka, Zambia; minutes from a leadership retreat, Lusaka, Zambia.

Reflections on the Role of Donors in Scaling Up Nutrition in Zambia from 2010 to 2013: Successes, Challenges and Lessons Learnt

Silke Seco Grütz, Maurice Sadlier and Dominique Brunet

Abstract In Zambia, the Scaling Up Nutrition (SUN) movement has provided an unprecedented opportunity to situate nutrition high on the agenda. Since Zambia joined SUN, nutrition has acquired an increasingly important political profile. However, this has yet to translate into improved implementation of nutrition interventions. Applying the key SUN principles, donors have played a pivotal role by aligning resources behind one evidence-based national multisectoral nutrition plan. This article reviews donors' roles in: (1) coordination of assistance for policy development, programme design and implementation; (2) advocacy and strategic lobbying for political commitment; and (3) mobilising resources and support. It examines key successes such as the launch of the First 1000 Most Critical Days Programme; challenges such as seeking acceptance of politically unpalatable evidence on stunting, and handling misconceptions among senior officials; and the need to resolve donors' own neglect of nutrition, and responsive funding processes. Finally, it reflects on lessons learnt from the HIV response.

1 Introduction

In Zambia, undernutrition is a major human and economic development challenge, with higher rates than average for Africa (NFNC 2011a). The first Millennium Development Goal called for the eradication of extreme hunger, using the prevalence of underweight children under five as a progress indicator. Although Zambia experienced a decrease in the proportion of underweight children under five from 21 per cent in 1992 to 15 per cent in 2007, progress against stunting has been stagnant and the proportion remains unacceptably high, with 45 per cent of children under five classifiable as stunted (CSO *et al.* 2009).

Micronutrient deficiencies in iron, zinc, vitamin A and vitamin B12 are also common in Zambia due to the heavy reliance on monotonous plant-based diets. Anaemia prevalence, an indicator of iron deficiency, stands at 61 per cent in children under five (MOH 2010). However, remarkable progress has been made in eliminating iodine deficiency through use of iodised salt, with iodine deficiency in school children reducing from 74 per cent in 1992 to 4 per cent in 2002 (NFNC 2011b).

Until Zambia became signatory to the Scaling Up Nutrition (SUN) movement in early 2011, policies focused on maize-based food production with minimal attention to broader nutrition and diet diversity issues. Existing nutrition policies and strategies were largely unimplemented due to inadequate resources, lack of effective coordination and leadership, absence of a nutrition donor group, insufficient strategic advocacy and communication, and weak monitoring. Nutrition interventions were also fragmented, not at scale and fell mostly within the health sector.

Zambia is now at a different stage in addressing undernutrition. The new National Food and Nutrition Strategic Plan (NFNSP) (NFNC 2011a) and the First 1000 Most Critical Days Programme (First 1000 MCDP) focus on the prevention of stunting in pregnancy and children under two years of age. The programmes aim to scale up a multisectoral package of cost-effective nutrition interventions with expected high long-term benefits to cognitive development, individual earnings and economic growth. This unprecedented national interest for nutrition culminated in the endorsement of the Global Nutrition for Growth Compact by the Government of Zambia in June 2013.

However, this move has yet to translate into improved and scaled implementation of nutrition interventions on the ground – interventions which call for additional financial and human resources as well as stronger inter-sectoral coordination and governance of the nutrition sector. This article describes how donors have applied the SUN principles to position nutrition higher on the national development agenda, and secured increased resources behind priorities for nutrition.

2 The launch of SUN in Zambia

In 2010, the Scaling Up Nutrition initiative was launched globally against a backdrop of disappointing progress in reducing undernutrition and a need to step up the pace of nutrition interventions to meet Millennium Development Goal 1 (MDG 1) and contribute to MDG 2 (universal primary education), MDG 4 (reducing child mortality) and MDG 5 (improving maternal health) by 2015.

In late 2010, an informal nutrition group was established by the UK Department for International Development (DFID) and UNICEF and joined by Irish Aid to improve

coordination of support by donors. The group facilitated Zambia's incorporation into SUN and in February 2011 Zambia became one of the first 'SUN early riser countries', committing the country to applying the SUN principles and implementing the SUN road map. The National Food and Nutrition Commission (NFNC), the advisory and coordinating government arm for nutrition, was nominated as the SUN government focal point. The existing donor group then became formally the SUN donor group, with DFID and UNICEF as co-convenors and new member-organisations including USAID, the World Food Programme (WFP), the World Bank, the European Union, Swedish International Development Cooperation Agency (SIDA) and the World Health Organization (WHO). The role of this group is to support the government in scaling up nutrition at country level and achieve the objectives of the NFNSP, focusing on preventing stunting in the first 1,000 days of life. The global momentum on nutrition helped to galvanise donor coordination at country level. Mirroring other sector donor groups such as HIV and health, the SUN donor group meets regularly to discuss key nutrition issues and keeps other sector groups informed of key developments.

3 The role of donors in scaling up nutrition

3.1 Coordination of assistance for policy development, programme design and implementation

The SUN road map (SUN 2010a) called for better alignment of nutrition assistance from development partners behind national priorities. Thus, and in line with the Paris and Accra harmonisation principles, the SUN donor group began to engage with the NFNC and the Ministry of Health (MOH). This engagement began with the group's support for Zambia's application to join SUN, as discussed above. From the outset, strong coordination of support and collaboration among donors has been instrumental in achieving progress.

The Lancet Maternal and Child Nutrition Series (The Lancet 2008, 2013) and the SUN Framework (SUN 2010b) are clear on the need for a multisectoral approach to address undernutrition. Following the current evidence base, donors in Zambia supported the development of the first multisectoral NFNSP with both financial and technical resources. The plan was developed with broad multisectoral consultation and has been endorsed by five key ministries involved in nutrition: (1) Health; (2) Community Development, Mother and Child Health; (3) Agriculture; (4) Education; and (5) Local Government and Housing. The coordination of donor technical assistance was important for an effective development plan process, as was the extensive consultation supported to secure broad buy-in for the final plan.

Recognising significant financial and human resource gaps in the sector, and that the NFNSP is an ambitious plan given the very high stunting levels, donors and government decided to start by focusing efforts on the first 1,000 days of life. As with the NFNSP, donors provided technical and financial support to develop the First 1000 MCDP which, in essence, operationalises the first strategic priority of the NFNSP. A key element of this support was the establishment of a multi-disciplinary technical support team working closely with the NFNC. Ensuring that the process focused on both nutrition-

specific and nutrition-sensitive interventions, and that it took due consideration of gender and governance, has resulted in a comprehensive approach to addressing chronic undernutrition in Zambia. The recently established SUN Fund, a catalytic pooled funding mechanism, will provide donor financial support to the implementation of the First 1000 MCDP. It will promote progressive matched funding and supportive actions by government in addition to financial support from other donors who are not part of the pooled funds.

3.2 Advocacy and strategic lobbying for political commitment

Harris and Drimie (2012) identify three barriers to inter-sectoral coordination for nutrition: (1) low political commitment and mobilisation; (2) sector-bound organisation structures and weak coordination bodies; and (3) lack of human resources and capacity. These all stand true for nutrition in Zambia. In the Hunger and Nutrition Commitment Index (Lintelo *et al.* 2013) Zambia ranks 17th out of 45 countries and is classified as having moderate political commitment to nutrition. Thus, donors have been actively engaged in advocacy for nutrition since 2010, applying a number of strategies, as described below.

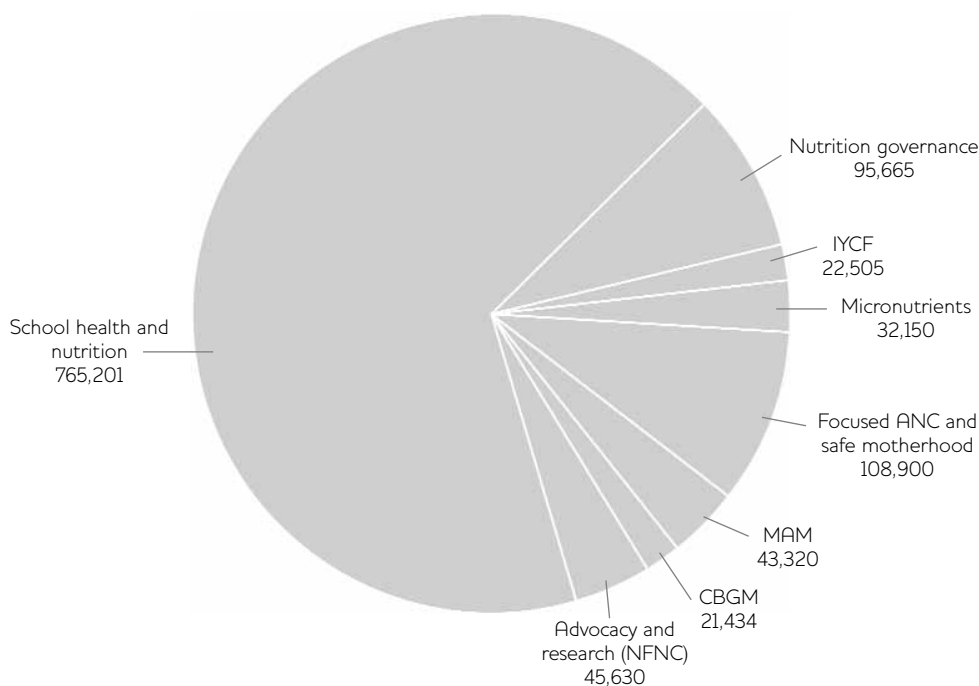
International exposure of national stakeholders to the SUN movement

Supporting international exposure to nutrition fora has been instrumental in building up a core group of Zambians, namely the SUN government focal point, parliamentarians, ministers and civil society representatives, who understand the evidence and the urgency of the situation. It has also helped establish links with the SUN movement, creating a sense of ownership and commitment. While vital in earlier stages, the proliferation of global nutrition and SUN-related meetings in 2013 has paradoxically caused this support to become somewhat problematic. It has led to the expectation that donors should be relied upon to fund participation at these events and it means that key policymakers and programme implementers spend significant amounts of time attending international meetings.

Raising nutrition awareness internally and externally

As noted in the SUN Framework (SUN 2010b) 'recent evidence on high development returns to selective nutrition interventions is generally not well known outside nutrition circles in many developing countries'. Although SUN has now gained large support, the evidence and messages of what works to address undernutrition are not universally known nor accepted. Therefore, advocacy to secure support for nutrition has been a key donor focus. Firstly, work was needed within donor agencies to achieve buy-in and secure funding for the nutrition agenda. Secondly, much effort has been spent in increasing engagement and support for nutrition among the wider donor community. Thirdly, the nutrition donor group has advocated extensively for greater commitment from the Zambian government. Taylor (2012) highlighted the opportunity presented with the new government following elections in September 2011. Nonetheless, undernutrition remained low on the government's agenda. In 2012, facing difficulties in getting increased government buy-in, donors developed a more structured advocacy plan. The plan sought to promote higher political will through coordinated and strategic

Figure 1 Budget allocation for nutrition-specific programmes in 2014



Note Total Ministry of Community Development, Mother and Child Health (MCDMCH) budget – US\$350 million, of which nutrition interventions have a total allocation of US\$228,000, and the total nutrition-specific budget allocation across government is US\$1.3 million. IYCF = Infant and Young Child Feeding; ANC = antenatal care; MAM = moderate acute malnutrition; CBGM = community-based growth monitoring. Source Adapted from SUN CSO (2014).

policy dialogue, identifying key people to target, key messages and key asks from government. It is only since the endorsement of the Nutrition for Growth Global Compact by Zambia at the high-level summit held in the UK in June 2013, that the picture is beginning to change.

Supporting the government nutrition focal point

Since the 1990s, many studies have identified similar shortcomings with the focal government point for nutrition, the NFNC. These include institutional weaknesses as identified by Schwerzel (2012); Taylor (2012); and Lintelo *et al.* (2013) but also its lack of ‘political clout’ among other ministries. Donors have addressed these weaknesses by supporting the NFNC in developing an advocacy and communications plan, as well as building up its inter-sectoral engagement. Donors have also called on other ministries and the Office of the Vice President to strengthen the management and accountability of NFNC.

Supporting civil society

Before 2012 there was very limited CSO collaboration and voice on nutrition. Donor provision of technical and financial support to the nascent Zambia SUN-CSO Alliance has since then proven to be immensely successful. Under strong leadership, the Alliance has become a key stakeholder in nutrition in Zambia and globally, as well as a key ally in scaling up nutrition.¹

3.3 Mobilising resources: establishing a SUN Fund

In addition to better alignment among donors, the SUN road map called for increased resources to support the implementation of national multisectoral nutrition plans. As mentioned earlier, nutrition interventions in Zambia

remain largely fragmented and under-resourced. Government allocations to nutrition budget lines are highly inadequate and far from reaching the estimated US\$30 per child under two that are needed to scale up a package of cost-effective nutrition interventions to about 90 per cent (*The Lancet* 2008; Horton *et al.* 2010). The total 2014 budget for nutrition-specific infant and young child-feeding interventions for instance is only about US\$230,000, excluding salaries. The Government of Zambia doubled the health and nutrition budget in 2013, but very low budget allocations for nutrition have been the trend for many years. Figure 1 shows a breakdown of the nutrition-specific budget for 2014. In addition, Zambia has very few positions for nutritionists, and resources to support nutrition training and capacity building are inadequate. Until recently, there were no university courses and nutrition as a profession remains marginalised and misunderstood.

The SUN Fund was conceived as a catalytic mechanism to mobilise financial resources in support of the national First 1000 MCDP and established in 2013 by pooling funds from various donors (DFID, Irish Aid, SIDA). It is managed by a management agency which was competitively selected and will support all programme components: scaling up priority interventions, institutional strengthening and coordination, communications and advocacy, capacity building and monitoring and evaluation. As institutional capacity for nutrition and financial management strengthens, it is hoped that donor resources will flow directly to government.

Most resources will support government efforts to scale up nutrition, particularly at district level and starting with 14 ‘phase one’ districts through both national and district

grants. The remaining funds will be available for complementary and innovative efforts by non-governmental organisations (NGOs), academia, private sector and others on a competitive basis. The SUN Fund is governed by a steering committee (SC) comprising representatives from government and donors. The SC provides overall oversight of the Fund and makes decisions over funding allocations based on district and national-level work plans and priorities.

The SUN Fund intends to leverage government and other non-pooling donor resources, as well as progressively encourage increased government allocations to nutrition. In the absence of tangible human resource and financial government commitments, it will be difficult for donors to obtain further funding to support SUN efforts beyond the current agreed allocations.

Estimating how much it will cost to implement the First 1000 MCDP was difficult and largely based on global aggregates, but it proved invaluable in mobilising resources from donors who wanted to cover the 'gap'. The costing needs to be refined to take into account the specific situation in Zambia, as well as the cost of strengthening and putting in place an effective service delivery and community platform.

4 Key successes

The hard work, facilitation and intense advocacy by donors and key allies over the past few years are beginning to bear fruit and have resulted in a number of concrete successes as described below.

National launch of the NFNSP and the First 1000 MCDP

The support provided to develop the NFNSP and the First 1000 MCDP culminated in the national launch of both plans by the Vice President in April 2013. All key ministries engaged in nutrition were present at the event and the SUN-CSO Alliance launched a 'One Thousand Days' song. Responsibility for implementing the First 1000 MCDP falls primarily under the MCDMCH, this being the ministry which leads on the delivery of primary health care at district and community levels.

Zambia's endorsement of the Nutrition for Growth Global Compact

In June 2013, Zambia was represented by the Vice President at the UK high-level Nutrition for Growth event, endorsing the Nutrition for Growth Global Compact and making ambitious commitments to address stunting. The commitments include actions across the most pressing areas identified throughout the article:

- Resolving nutrition human resource gaps in the five key ministries at all levels;
- Increasing financial allocations to nutrition budget lines – by at least 20 per cent annually in order to get closer to the estimated US\$30 per child under two as recommended by the World Bank;
- Gradually matching increased donor contributions to nutrition;
- Progressively encouraging private sector engagement in the local production of nutritious complementary foods;
- Improving governance of the nutrition sector by establishing higher level oversight of the sector under

the Office of the Vice President and by strengthening the NFNC.

Zambia now ought to establish a road map with the concrete actions needed to meet these commitments, agree on how to measure progress and ensure higher level oversight of the sector.

A functional and active SUN Civil Society Alliance

While at the inception of SUN in Zambia there was no coordinated civil society action or voice for nutrition, there is now a functional and active CSO Alliance. The Alliance brings together over ten civil society organisations working in the areas of nutrition and social protection and has contributed significantly to raising awareness on undernutrition by engaging parliamentarians, the media and district level officials. It also plays an important role in making the government accountable and in monitoring commitments made.

A bigger and consolidated nutrition donor group

The small and informal nutrition cooperating partners group of 2010 has become a larger and well-established formal group convened by DFID and UNICEF, with membership from nine donor agencies. The group works according to clear terms of reference, includes health and agriculture representation and meets with government partners on a bi-monthly basis. Donors who are not able to join the SUN Fund are coordinating closely and supporting identified priorities through a variety of funding mechanisms.

Significant increase in resources for nutrition

Other than traditional partners such as the UN system, which has long supported nutrition interventions, there has been a significant increase in donor support to the sector. The SUN Fund has so far raised US\$27 million from donors to support the implementation of the First 1000 MCDP. In addition, the European Union has allocated support for nutrition interventions in ten districts as part of a new Health MDGs Programme, USAID's Feed the Future and Global Health Initiatives are aligned to the SUN and the World Bank is designing a new health systems support programme which includes nutrition and expects to cover over 40 districts.

5 Challenges

The previous sections have highlighted many of the common challenges faced in scaling up nutrition in contexts where there are limited financial and human resources. This section offers a reflection on particular challenges encountered in Zambia which may or may not apply to other settings. It also reflects on key challenges likely to be faced in the future.

Limited nutrition capacity

A key challenge is the limited capacity and nutrition expertise available in government, civil society and even donor agencies. Speaking up for nutrition in such a context has required a mammoth effort. In 2011, when Zambia joined SUN and the MOH was the main implementing body responsible for nutrition, there was only one nutritionist (who did not hold a director level position). In fact, no nutritionists in Zambia hold director or decision-making positions in government. The newly

established Human Nutrition BSc at the University of Zambia with support from donors will partly address this shortage and create a new cadre of highly qualified nutritionists and dieticians, but not in the short term.

Health sector reform

In 2013, the government decided to transfer primary health care from the MOH to a new ministry, the MCDMCH. While this move presents some opportunities for strengthening synergies across nutrition interventions – a number of poverty alleviation and social protection programmes fall under its remit – the ministry only has one nutrition officer and is struggling to absorb more than 20,000 staff transferred from the MOH as well as a new programme portfolio. In addition, plans to recruit three nutritionists are under threat because of the current recruitment freeze in the health sector. This shortage of nutritionists needs to be contextualised within Zambia's broader human resources crisis in the health sector, where more than 90 per cent of districts operate on less than half the optimal health staffing levels (MOH 2009).

Palatable and unpalatable truths

It is fair to say that undernutrition is largely unperceived by the Zambian elite and by those in positions of power, who tend to live and work in urban areas where levels of undernutrition are less visible. While Zambia has seen sustained economic growth over the past few years, with an average GDP of 7 per cent, it remains one of the most unequal countries in the world, ranking 164 out of 187 on the UN Human Development Index (2012) and with more than 60 per cent of the population living in poverty. The malnutrition of affluence, characterised by increasing levels of obesity with an associated burden of diabetes and cardio-vascular disease, seems to catch the attention of policymakers more easily. In addition, messages around the largely irreversible consequences of stunting, namely brain damage and impaired cognitive development, are often unpalatable to politicians and members of parliament, some of whom come from communities which have failed to reach their full potential.

In addition, the multisectoral and complex solutions needed to address undernutrition do not marry easily with the need for 'quick wins' by both governments and donors who tend to respond to short electoral cycles. Furthermore, misconceptions and a resistance to accepting the evidence base have been encountered even at senior policy levels. Understanding the WHO Growth Standards and the role of genetics for instance, might need more nuanced messaging, especially in populations where there has been mixing with ethnic groups famous for their short stature.

Nutrition leadership and multisectorality

Despite being a relatively well-staffed and funded national body responsible for coordinating nutrition actions and policy advice, with some strong technical staff, the NFNC is not an effective institution and it lacks the ability to convene high-level and nutrition-related actors. Also, being overseen by the MOH has meant that nutrition is often seen just as a health issue. As Harris and Drimie (2012) point out, the 'health sector tends to own nutrition'. In addition, the MOH has failed to act on any of the recommendations from the numerous institutional reviews

done since 1987. Reforming the NFNC and strengthening its organisational management will be crucial if it is to remain a key player in the nutrition response and promote multisectoral collaboration. New support by the World Bank to revise the outdated 1967 Act which defines the role of the NFNC and the establishment of a new Board present a positive development. The Board, however, needs to meet regularly and provide effective oversight of the NFNC, as well as support the implementation of key recommendations from past reviews.

Limited budgetary allocations for nutrition and ineffective agriculture policies

As noted earlier, current government expenditure on nutrition-specific interventions is grossly inadequate. In addition, agriculture plays a key role in responding to undernutrition but as Pinstrup-Andersen (2013) notes, food systems offer an underused opportunity. Cognisant of this, donors and the NFNC have ensured that the First 1000 MCDP includes agriculture-related activities such as increasing household dietary diversity. Furthermore, a number of nutrition-related programmes which fall under the Ministry of Agriculture and could potentially have a significant impact are largely ineffective. Two of these – the Federal Reserve Agency and Farmers' Input Support Programme – account for more than half of the total agricultural budget. However, they are focused on maize monoculture – with little incentive for crop diversification and negative impacts on nutrition – and fail to target the poorest.

Lastly, although the impact of poor sanitation and hygiene on growth is well known, insufficient resources are allocated to the water and sanitation sector in a country where rural improved sanitation coverage is estimated to be only 43 per cent and improved water coverage 46 per cent (WHO/UNICEF 2010).

A fragmented monitoring and evaluation system

The existing nutrition information system is fragmented and up-to-date data to inform programme design and implementation are not readily available. Aside from District Health Surveys which take place approximately every five years, specific nutrition surveys are periodically conducted with donor support but these are costly and time-consuming. With the renewed impetus on scaling up nutrition and increasing donor support for monitoring and evaluation, there is a real opportunity for Zambia to move towards an integrated monitoring and evaluation framework. The current NFNSP proposed framework of M&E indicators is too long. There is a need for government to take the lead in agreeing a common set of indicators that cut across several sectors but allow for focused measuring efforts.

6 Key lessons

6.1 Lessons from the three-year SUN process in Zambia

- Building the foundations to scale up nutrition in Zambia has been a long and painstaking process. What needs to be done is now widely acknowledged, with the plans and funding in place, but implementing the 'how' remains to be done and will not be easy.
- Donors working to scale up nutrition in countries where this is a neglected issue need to have an advocacy plan

with consistent messages and identified potential nutrition champions from the start.

- Building capacity for SUN at all levels is a prerequisite which may require donors to fund unconventional, longer-term training activities such as university courses and scholarships. Having a nutrition workforce plan as part of broader human resource strategies is also imperative.
- Given that scaling up nutrition is a long-term process and that donor approval processes tend to be protracted, it is important to identify well-established or innovative interventions that can be funded while the broader strategy comes into shape.
- Finally, it is clear that the long list of interventions proposed as the solution to undernutrition is overwhelming for governments. Everyone, including donor agencies, wants ‘magic bullets’. Donors and other funders need to understand that undernutrition is complex and will require a sustained effort across multiple fronts. Support to countries in identifying the most cost-effective packages would be useful but it is important to emphasise that investing in nutrition today will yield huge economic and developmental benefits in the medium to long term.

6.2 Some lessons from the HIV response

The SUN movement is already applying successful approaches from the HIV response, such as the coordination of support behind nationally-led strategies with one monitoring framework and the use of ‘champions’. In Zambia, where the HIV response is considered to be largely successful, there are some useful lessons for nutrition:

- The National AIDS Council (NAC) has played an important advocacy and coordination role but with a much higher political status and significant donor support. The NAC has recently been restructured to better align with the new National AIDS Strategic Framework. A similar process should be considered for the NFNC.
- The HIV response is still largely dependent on external funding at a time when HIV funds are decreasing. Donor resources should be gradually matched by increased allocations from government to build sustainability and ownership from the start. Nutrition’s moment is now. Resources need to be targeted to where they are most needed and to evidence-based interventions.
- Although we know much about the overall causes of undernutrition, as with the ‘know your HIV epidemic, know your response’ concept, more context-specific data, including formative research and epidemiological mapping on the drivers of undernutrition would help to better target resources and interventions.
- Given competing health priorities and limited financial and human resources, SUN efforts should be integrated into other maternal and child initiatives, particularly when it comes to the delivery of nutrition-specific interventions at district and community level.

6.3 What could have donors done better and how do donors in Zambia score against agreed SUN principles?

As well as reflecting on successes, it is important for donors to reflect on what could have been done better.

Three issues come to mind:

Firstly, an advocacy strategy to increase political commitment on nutrition should have been developed earlier. Most of the dialogue during the initial months was held with government counterparts at the technical level who had little influence over the broader political agenda.

Secondly, although three donors have been able to pool funding in support of the First 1000 MCDP, a bigger pool of donors would have probably set the path for a more joint implementation, with common reporting mechanisms and agreed disbursements. However, there is often limited flexibility for some donors to pool funds and compromises have to be made.

Lastly, the coordination of the UN agencies around nutrition has been sub-optimal at country level. However, a commitment to ‘delivering as one’ has been made and nutrition has become a UN signature issue for Zambia. This would allow capitalisation on strengths and comparative advantages of the different UN agencies towards the national goal of reducing stunting. The SUN pooled funds will also seek to support joint UN approaches.

Looking at the key SUN principles agreed to assess donor progress, cooperating partners in Zambia have significantly contributed to bringing people together, the establishment of coherent policies for nutrition and mobilising resources (indicators 1, 2, 4). However, as noted earlier, Zambia does not yet have an agreed multisectoral common results framework and efforts will be needed to ensure joint implementation around common results. In this regard, the jury is still out: the next two years offer a window of opportunity to further galvanise support and move towards a higher level of collaboration.

7 Conclusions and next steps

Despite numerous challenges, there is no doubt that Zambia has an unprecedented opportunity to significantly reduce undernutrition in the coming years. The foundation is now in place for a phased scale-up in a number of high-burden districts, including an agreed minimum package of interventions and the funding and technical support required.

For a truly multisectoral approach, not only the health sector, but also the agriculture, education and sanitation sectors, will need to strengthen their nutrition remit. The expansion of social protection offers great potential, but policies to incentivise diversified crop production need to be enacted.

Achieving sufficient coverage of interventions and demonstrating results are probably the most daunting tasks in terms of converting momentum into action. Zambia now needs to focus and monitor progress to show what works. To do this, it will be key to strengthen monitoring and evaluation in the sector and agreeing how to track progress. Sustained efforts and the definition of intermediate milestones will be needed to keep momentum, and to hold government and donors to account for what they have committed to deliver.

Note

- 1 Chilufya, in this *IDS Special Collection*, describes in detail the role of the SUN Civil Society Alliance in Zambia.

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Glossary

AAS	Aquatic Agricultural Systems
ADP	area development programme
AfDB	African Development Bank
AFF	Alliance Forum Foundation
AIR	American Institutes for Research
ANC	antenatal care
ANOVA	Analysis of Variance within groups
ART	antiretroviral therapy
BMGF	Bill and Melinda Gates Foundation
BMI	Body Mass Index
BMZ	German Federal Ministry for Economic Cooperation and Development
BoP	Base of the Pyramid
BRAC	Bangladesh Rural Advancement Committee
CAADP	Comprehensive Africa Agriculture Development Programme
CARE	Cooperative for Assistance and Relief Everywhere
CBGM	community-based growth monitoring
CBO	community-based organisation
CD	cluster of differentiation
CDC	Centre for Disease Control and Prevention
CER	cost-effectiveness ratio
CGIAR	Consultative Group on International Agricultural Research
CGP	Child Grant Programme
CGP	Child Growth Promoter
CHA	Community Health Assistant
CI	confidence interval
CIDA	Canadian International Development Agency
CIGNIS	Chilenje Infant Growth, Nutrition and Infection
CIMMYT	International Maize and Wheat Improvement Center [Bangladesh]
CIP	International Potato Center
CMAAE	Collaborative Masters Programme in Agricultural and Applied Economics
CSN	civil society network
CSO	Central Statistical Office
CSO	civil society organisation
CSO-SUN	Civil Society Scaling Up Nutrition
CTC	Community-based Therapeutic Care
CT-OVC	Cash Transfer for Orphans and Vulnerable Children
CWAC	Community Welfare Assistance Committee
DALY	Disability-Adjusted-Life-Years
DD	difference-in-differences
DDCC	District Development Coordinating Committee
DDS	diet diversity score
DFID	Department for International Development
DHA	docosahexaenoic acid
DHMT	District Health Management Team
DHS	Demographic and Health Survey
DMO	District Medical Officer
DNCC	District Nutrition Coordinating Committee
ECA	Economic Commission for Africa
EPA	eicosapentaenoic acid
ESARO	Eastern and Southern Africa Regional Office (UNICEF)
FAO	Food and Agriculture Organization of the United Nations
FISP	Farmer Input Support Programme
FRA	Food Reserve Agency
GAIN	Global Alliance for Improved Nutrition
GRZ	Government of the Republic of Zambia
HAZ	height-for-age z-score
HDDS	Household Dietary Diversity Score

HEPS	High Energy Protein Supplement
HGFP	Home Grown Feeding Programme
HIV	human immunodeficiency virus
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDD	Iodine Deficiency Disease
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILO	International Labour Organization
ILSI	International Life Sciences Institute
IMAM	Integrated Management of Childhood Illness
INDABA	Indaba Agricultural Policy Research Institute
IYCF	Infant and Young Child Feeding
LA	local authority
LCIRAH	Leverhulme Centre for Integrative Research on Agriculture and Health
LCMS	Living Conditions Monitoring Survey
LMIC	lower middle-income country
M&E	Monitoring and Evaluation
MACO	Ministry of Agriculture and Cooperatives
MAL	Ministry of Agriculture and Livestock
MAM	moderate acute malnutrition
MCDP	[First 1000] Most Critical Days Programme
MCDMCH	Ministry of Community Development, Mother and Child Health
MICS	Multiple Indicator Cluster Survey
MOH	Ministry of Health
MP	member of parliament
MQSUN	Maximising Quality in Scaling Up Nutrition
MUAC	mid-upper arm circumference
MUACZ	mid-upper arm circumference z-score
NAC	National Aids Council
NACA	Network of Aquaculture Centres in Asia-Pacific Bangkok
NAIP	National Agriculture Investment Plan
NBR	Net Benefit Ratio
NCHS/CDC	National Centre for Health Statistics/Centres for Disease Control and Prevention
NFNC	National Food and Nutrition Commission
NFNP	National Food and Nutrition Policy
NFNSP	National Food and Nutrition Strategic Plan
NGO	non-governmental organisation
NISP	National Input Subsidy Programme
NNSS	National Nutrition Surveillance System
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
ORS	Oral Rehydration Salt
OTP	outpatient therapeutic programme
PAM	Programme Against Malnutrition
PATH	Program for Appropriate Technology in Health
PD	positive deviance
PDH	Positive Deviance/Hearth
PDI	positive deviance inquiry
PHO	Provincial Health Office
PI	Principal Investigator
PLAAS	Institute for Poverty, Land and Agrarian Studies
ppb	parts per billion
PRSP	Poverty Reduction Strategy Paper
RAAZ	Rural ART Adherence Zambia
RAIN	Realigning Agriculture to Improve Nutrition
RCT	Randomised controlled trial
RENEWAL	Regional Network on AIDS, Livelihoods and Food Security
RPM	Rational Pharmaceutical Management
RUTF	ready-to-use therapeutic food
SADTI	Sustainable Agriculture Development and Training Initiative
SAFL	Southern Africa Food Lab
SAM	Severe acute malnutrition

SCT	Social Cash Transfer
SCUK	Save the Children UK
SD	standard deviation
SDC	Swiss Agency for Development and Cooperation
SE	standard error
SFP	supplementary feeding programme
SIDA	Swedish International Development Cooperation Agency
SNDP	Sixth National Development Plan
SPSS	Statistical Package for Social Scientists
SUN	Scaling Up Nutrition
TDRC	Tropical Diseases Research Centre
UNICEF	United Nations Children's Fund
UNZA	University of Zambia
UNZAREC	University of Zambia Biomedical Research Ethics Committee
USAID	US Agency for International Development
USG	US government
WAZ	weight-for-age z-score
WFP	World Food Programme
WHO	World Health Organization
WSUP	Water and Sanitation for the Urban Poor
ZDHS	Zambia Demographic and Health Survey
ZMW	Zambian kwacha

Relevant IDS Publications

Barnett, I. and Befani, B. with Sulisty, S.; Yosellina and O'Leary, M. (2014)
A Mixed-Method Impact Evaluation Design of a Mobile Phone Application for Nutrition Service Delivery in Indonesia, IDS Evidence Report 79, Brighton: IDS

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The level of undernutrition in Zambia is high and persistent. The increasing commitment of Zambian and international stakeholders to changing this situation holds out the prospect of a real decline in undernutrition over the coming years. In addition, the current strong growth of GDP per capita is potentially a positive driver of future undernutrition decline. Despite these increased opportunities for undernutrition reduction, however, there are several real threats to progress. Based on a combination of research evidence and long experience of working in the country, the authors in this *IDS Special Collection* describe some of these opportunities and threats in Zambia and suggest ways of seizing the former and dealing with the latter.

The articles in this *IDS Special Collection* show how the commitment to nutrition has been built in Zambia, and provide some pointers and guides to the ways in which that increased commitment could be leveraged to raise resources and how to allocate these. Zambia is potentially on the cusp of a great economic transformation. Can gains in economic growth from temporary mineral resources be translated into gains in child growth which reduce mortality and suffering, as well as serving to power economic growth in a sustainable way? Or will we see a situation where current fast economic growth is another redundant flash in the pan? By investing much more of their increasing stream of tax revenues in malnutrition-reducing efforts, Zambian policymakers can make the transformation vision much more likely. In this way, economic growth can be made more sustainable and more transformative. Investing in the most vulnerable members of its society – children under the age of two and their mothers – is a sure-fire way for Zambia to turn fast economic growth into meaningful growth, not only of its economy, but of its population.