

What drives nutrition policy reform in Africa? Applying the Kaleidoscope Model of Food Security Policy Change

Sheryl L Hendriks, Suresh C Babu and Steven Haggblade

Introduction

Interest in nutrition policy has gained political momentum in recent years. Several key international events and commitments following the 2007–2008 food price crisis raised awareness of the need to improve nutrition to achieve international, regional, and national development and growth targets that support the realization of the right to food and various rights related to children. Signatories of the first Nutrition for Growth Summit, held in London in 2013, committed their political will and financial resources to work in partnership to accelerate progress toward achieving World Health Assembly targets by 2025. The Scaling Up Nutrition (SUN) movement and the 2014 Rome Declaration on Nutrition from the Second International Conference on Nutrition reiterate this commitment. These efforts informed the drafting of the Sustainable Development Goals (SDGs), especially SGD2. Implementing these commitments at the national level requires appropriate interventions supported by enabling policies, sound institutions and good governance. Yet, such policy making processes are poorly understood.

Worldwide, three major micronutrient deficiencies dominate public health attention. These include iodine, iron and vitamin A. These deficiencies can be dealt with through the promotion of more diversified diets (food-based approaches), supplementation, fortification and biofortification. Supplementation involves the administration of vitamins and minerals through tablets, capsules and sprinkles of single nutrients or combinations of these. Fortification involves the addition of single or multiple micronutrients to processed foods that are widely consumed by the population in general or by specific targeted groups of people or through breeding crops and animals (biofortification). Implementing these interventions requires appropriate policy environments, appropriate coordinated institutional arrangements and strengthened policy processes at the national levels.

Key Findings

- Except for iodine, the reduction of micronutrient deficiencies in sub-Saharan Africa has been suboptimal despite efforts to address micronutrient deficiencies.
- The Kaleidoscope Model was useful in identifying the drivers and constraints change in micronutrient policies in the developing world.
- Common drivers included: the global knowledge base, call for action and international targets; national leadership and champions and support of the development partners
- Differences were seen in: the level of engagement with various stakeholders; design and funding considerations; the institutional and regulatory infrastructure and long-term investment in sustainable solutions.
- The results indicate that salt iodization has successfully reduced deficiency levels.
- Vitamin A fortification and supplementation have had limited success due to implementation challenges.
- Biofortification offers population-wide opportunities for enriching the nutritional value of foods.

This paper compares the findings of three in-depth case studies of micronutrients policy processes in Malawi, South Africa and Zambia (respectively, Babu et al. 2016; Hendriks et al. 2016; Haggblade et al. 2016). Such studies help us understand what drives, prevents and delays policy change; how to motivate and initiate change processes and who the best partners are to set change in motion. Comparative analysis of policy processes in nutrition provides insight into how to support policy dialogue and reform in order to deliver on the commitments made to improve nutrition.



Methodology

The analytical framework for this comparative analysis and the three case studies were guided by the Kaleidoscope Model of Food Security Policy Change, which provides a systematic framework for analyzing variations in policy reforms over time and across countries (see Resnick et al., 2017). The Model identifies a set of 16 hypotheses that collectively serve as *key determinants* to explain when and why policy change occurs. As seen in the inner circle of Figure 1, the Model maps these 16 hypotheses into five key elements of the policy cycle: agenda setting, design, adoption, implementation, and evaluation and reform. In turn, a non-exhaustive range of illustrative contextual conditions set out in the internal grey circle shapes these variables. The Model's name reflects that just as shifting a kaleidoscope refracts light on a new pattern, so does focusing on a particular stage of the policy process identify a different constellation of key variables that are important for driving change. Like the pieces of a kaleidoscope, many of the contextual conditions remain the same, but as policy dynamics unfold, some factors tend to play a disproportionately stronger role in driving toward policy change than others at any particular point in time (Resnick et al., 2017).

The three case studies (Babu et al., 2016; Hendriks et al., 2016; Haggblade et al., 2016), were conducted in Malawi, South Africa and Zambia during 2015/6. Each study included extensive reviews of published documentation and semi-structured interviews, which along with stakeholder maps provided insights into the policy process.

A regional consultative workshop was held in Pretoria in September 2016 to present and validate the findings. This workshop included policy makers, international organizations, representatives of the private sector, academics and government officials. The final comparison benefitted from this rich discussion.

Slow progress but way off target for some micronutrients

Iodine deficiency has reduced in all three countries over time, but the same trend is not seen with regard to vitamin A and iron, where in some cases, the incidence of deficiency has increased despite universal vitamin A and iron supplementation of children and mandatory fortification programs. While there is ample international evidence that these interventions should hypothetically produce better results, little evidence exists to explain why they perform so poorly and how to initiate policy change to address their shortcomings.

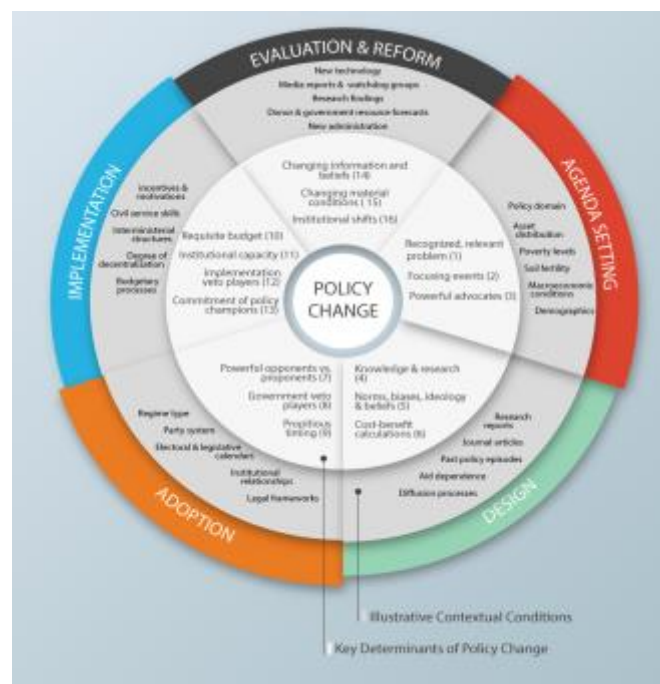


Figure 1: The Kaleidoscope Model of Food Security Policy Change. Source: Resnick et al., 2017.

Iodine fortification: Same solution but different timing and impact

Salt is widely consumed and evidence from as early as the 1920s showed that fortifying salt with iodine is effective and has relatively low costs. Mandatory iodization programs only came into being after the 1990 World Summit on Children despite being a well-recognized public health problem with well documented incidence in the 1940s, 1950s and 1960s and wide-spread concern among medical practitioners. The Summit produced a global agreement on universal salt iodization with the goal of eliminating iodine deficiencies by 2000. This triggered broad action to introduce and enforce salt iodization mandates. All three countries have mandated salt iodization from the 1990s.

Addressing Vitamin A deficiencies: Different vehicles and differing outcomes

The 1990 World Summit on Children also highlighted the importance of vitamin A supplementation for women and children. Malawi, South Africa and Zambia made commitments at the Summit to address vitamin A deficiency as national surveys confirmed wide-spread vitamin A deficiency. International attention to the issue and a ready solution in the mega dose administration of vitamin A to children between six and 24 months helped the adoption of this intervention in all three countries.

The availability of software from USAID's MOST Program called *Profiles* and USAID-funded Basic Support for Institutionalizing Child Survival (BASICS) Program also

enabled evidence-driven inputs on the assessment of the cost, feasibility and lives lost should a specific intervention not be implemented. This allowed for the preparation of convincing evidence to be presented to policy makers. Direct funding, as well as operation support on the rollout of supplementation programs, played a role in adoption of these interventions.

The binding requirement for countries to report on commitments made at the 1990 Summit on Children to the United Nations Committee on the Rights of the Child forces governments to monitor coverage and evaluate the impact of supplementation programs. The feedback from this Committee has been used as rallying points for the allocation of appropriate resources and the development of comprehensive policies and programs, particularly in South Africa.

While there are many common elements in the process of policy change with regard to the adoption and implementation of vitamin A supplementation policies in the three countries, the vehicles and processes for the fortification of foods with vitamin A have been very different. All three countries have universal supplementation programs of infants implemented through their national health systems. Recent concerns have likewise emerged over possible over-dosing of vitamin A through the mega dose administration to children.

For over 50 years, private companies in Malawi voluntarily fortified vegetable oil with vitamin A. However, this ended in recent years due to corporate reorganization and reorientation. Fortification of margarine with vitamin A and D has been mandatory in Zambia since 1978, but does not seem to be actively enforced or very effective. The latter may be due to low consumption among the poorer groups of the population.

The fortification of sugar and flours has been very contentious in all three countries. The choice of the vehicle for fortification with vitamin A was informed by food consumption patterns. Malawi and Zambia chose sugar as the vehicle for vitamin fortification while South Africa chose not to fortify sugar. In South Africa, vitamin A is part of a multi-mix of fortificants added to maize and wheat flour.

Although fortification discussions began in Zambia in May 1996, these focused initially on maize meal. However, fortifying maize meal requires large-scale, centralized commercial processing. Most maize meal consumed in Malawi and Zambia is hand processed or processed by local hammer mills. Both countries chose to focus fortification attempts on sugar.

Initial attempts to fortify sugar with vitamin A in Malawi and Zambia were unsuccessful due to objections related to the increased cost of sugar production from the only manufacturer operating in both countries. UNICEF played a key role in negotiating and convincing both governments and the private millers to fortify sugar. USAID supported the industry with equipment, training and technical expertise. Zambia started fortifying sugar in May 1998. Malawi took far longer to mandate fortification than Zambia. Fortification of processed foods such as sugar, oil, wheat flour, and maize meal with vitamin A was gazetted in Malawi in early 2015.

The options for fortification in South Africa were identified through national food consumption surveys. South Africa's decision to drop sugar from the list of possible vehicles for vitamin A fortification was based on a number of factors. According to cost-benefit calculations, fortifying maize meal was cheaper than fortifying sugar. The nutrition fraternity and dentists lobbied strongly against fortifying sugar, stating that the promotion of an "unhealthy" food for better nutrition would be counter-intuitive and counter-productive. The South African sugar industry contended that the cost of fortification would result in high levels of competition and unfounded claims that European importers would reject fortified sugar. The Zambian company raised similar concerns about regional trade.

As both supplementation and fortification provide preformed vitamin A (in the form of retinol), they can lead to overconsumption of vitamin A. This concern has led to increased interest in biofortified crops as an alternative to these mega doses of vitamin A.

Iron: What is the sticking point?

Despite equally convincing evidence of iron deficiency in all three countries and the wide-spread recognition that iron deficiency is a major constraint to human productivity (especially for women and children), progress in the reduction of iron deficiency and anaemia has been slow throughout the world. In 2012, the World Health Assembly sanctioned a target to decrease the rate of anaemia by 50 per cent by 2025. The 2016 Global Nutrition report highlights that, at the current rate of progress, this target will only be met by 2124 (IFPRI, 2016).

In Malawi, South Africa and Zambia, iron folate is provided through antenatal clinics and to adolescent girls through schools in Malawi and Zambia (Table 3). International evidence confirms the effectiveness of these programs on the overall rates of anaemia in women and children. However, due to poor coverage and non-compliance with taking iron supplements, the expected results have not been achieved. Only pregnant women who have access to an antenatal clinic are typically covered through public health

programs. In South Africa, stock-outs at health facilities are common. Recent improvements in women and children's iron status in South Africa appear to be linked to maize meal and wheat flour fortification rather than supplementation alone.

Recent evidence has raised concern over iron supplementation programs in areas with endemic malaria. A 2006 study (Sazawal et al. 2006), in Tanzania observed higher rates of hospital admissions and mortality among patients receiving iron and folate supplements. The study raised a concern that universal supplementation of children with iron and folate in areas of high malaria transmission might be harmful.

There is increasing recognition of the need to broaden the strategies for improving iron accessibility through food fortification (focused particularly on maize meal), dietary diversification and bio-fortification. The Zambian government has been particularly proactive in this regard, with the Zambian Agricultural Research Institute releasing a high-iron bean variety in 2013. On-going research aims to produce more varieties from cross breeding with local varieties.

Multi-mixes in fortification: Complex decisions

One of the main rally points for policy change in South Africa was deregulation of the milling industry in 1991 and disbandment of the control boards. Based on a 1994 national food consumption survey, mandatory multiple fortification of maize meal, white and brown wheat flour, as well as white retail sugar was recommended.

A 1994 survey of consumption and deficiencies was funded by UNICEF. The USAID's MOST project also provided short-term technical advice on fortification from 1999 onwards. In 2002, South Africa was awarded a grant from the Global Alliance for Improved Nutrition (GAIN) to implement the fortification program.

Mandatory maize meal and wheat bread flour fortification came into effect in October 2003 in South Africa. The micronutrients included in the fortification mix were vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc. The launch of the fortification program marked the transition of external funding for the project from the Micronutrient Initiative to GAIN. UNICEF handled all procurement, technical reporting and financial administration. To increase compliance among small millers, the Micronutrient Initiative provided funds towards a large-scale mapping and needs assessment project that was conducted by the University of Pretoria.

In Malawi, once the decision was made to fortify sugar, other foods were gazetted for micronutrient fortification in

2015. These include wheat flour, maize meal, corn-soya blend and vegetable oil. Malawi fortifies maize flour with folic acid, iron, vitamins B1, 2 and 12, niacin, zinc and vitamin A.

There have been multiple efforts to introduce vitamin A fortified maize meal as well as fortification with iron and a mix of various B vitamins in Zambia. However, voluntary experiments by some large millers led them to resist efforts by the government to mandate these efforts. In part, they feared consumer rejection of a new product. During the early voluntary efforts, rumors circulated about food safety, an unusual taste and possible loss of fertility from consuming fortified maize meal. Moreover, Zambia's 45 large millers feared a competitive disadvantage if government imposed fortification on them. It was feared that as government monitoring agencies did not have the capacity to enforce fortification on Zambia's many thousand small hammer mills, these small producers would easily undercut the large millers on price and thus erode their market share and profit margins.

In 2004, GAIN provided funding for equipment and premix stocks for 30 millers in Zambia. GAIN also provided technical support and training for the millers, bringing in fortification consultant to work with local industry. At the last minute, the President's Office instructed that all work on the maize meal fortification standards stop.

Such occurrences raise interesting questions regarding how policy change occurs or stalls. In the light of pressing need to improve the nutritional status of populations and specific target groups within these, we turn to an assessment of the five stages of policy change, looking at the role that key determinants played in Malawi, South Africa and Zambia with regard to micronutrient-related policies.

Nutrition Re-emerges on Policy Agendas

In all three cases, evidence from international surveys and advocacy concurred with national survey data and observations and led to renewed *recognition* of nutrient deficiencies as a *relevant problem* in terms of health, child development and human productivity. Status reviews reports, expert task forces and committees, as well as national surveys formed an important part of the agenda-setting process, informing officials and decision makers in defining the problem, establishing the nature and extent of the problem and identifying possible policy instruments to address the problem. Externally funded studies provided assessment of the cost, feasibility and productivity gains from fortification. However, local research also played a role in informing the agenda setting stages in these three countries. Local university research groups have played

important roles in establishing the evidence-base and documenting the problem, while also playing a role in advocacy in the agenda setting-stage.

The role of *focusing events* was very evident in the micronutrient case studies. Multiple international conventions - on the rights of children in particular - initiated the adoption of international best practice solutions in nutrition – especially the rolling out of supplementation programs for targeted groups. In the early 1990s, three global events set the stage for national discussions, namely: the World Summit for Children (1990, convened by the Zambian government); the Policy Conference on Hidden Hunger (1991); and the first International Conference on Nutrition (1992). The Hidden Hunger meeting helped assemble international evidence and experiences on salt iodization. *Lancet* special issues documenting the pervasiveness of micro-nutrient deficiencies as well as potential solutions have also assisted in providing international evidence documenting the need for interventions and providing program design guidance. Following the World Summit for Children, countries developed National Plans of Action for Nutrition, supported by UNICEF and WHO. Reporting on these plans creates regular focal points for review, reflection and revision of policies. They also provide additional focusing events and opportunities to lobby for improvements in countries. These international events converged with South Africa's transition to democracy in 1994 and a period of significant policy change. In Zambia, in 1994 and 2001, international advocates strongly shaped the agenda with regard to salt fortification standards. UNICEF and other donors supported the National Food and Nutrition Council and its various task forces to assess iodine deficiency levels, review salt fortification standards, ensure proper enforcement and rectify the shortcoming of the 1978 mandate by requiring imported salt to be fortified before it could enter into Zambia.

The drought in 2001 and the announcement of the food crisis in Malawi malnutrition discussions, supported by evidence from a localized survey conducted by Save the Children. The food security and nutritional status of the HIV/AIDS affected population became a major concern for the Malawian government.

Powerful advocates and advocacy coalitions also played a strong role in agenda setting during this period. During the 1990's, all three countries introduced mandatory iodine fortification salt, while Malawi and Zambia introduced vitamin A supplementation programs in response to strong leadership and lobbying by UNICEF and other donors. More recent traction seems to have been made with high level support. President Bingu commissioned the draft of the 2007 nutrition policy for Malawi and established a

Department for Nutrition Health and HIV/AIDS. In South Africa, President Nelson Mandela's support for children was a powerful influence in the adoption of nutrition as a policy priority. The champion of the Malawi National Nutrition Plan transition was Dr. Mary Shawa. Her work raised attention to both nutrition and HIV/AIDS. Several interviewees also mentioned that the leadership of Mary Shawa as Principal Secretary in the Office of the President and the Cabinet was an important factor that helped to increase the political visibility of nutrition related issues.

International organisations were strong proponents of iodine fortification in each country (notably UNICEF and USAID). In Malawi, the role of NGOs and civil society has been notable. The multi-stakeholder Malawi Nutrition Fortification Alliance is responsible for developing and monitoring fortification activities in Malawi. Recently, the Scaling up of Nutrition (SUN) initiative has helped to bring together donors and national entities for better coordination of nutrition intervention programs in Malawi.

Local champions and powerful advocates in Malawi, supported by international agencies and technical expertise provided by donors have played significant roles in advocacy for nutrition. These include UNICEF, GAIN, the Micronutrient Initiative, USAID, WHO and other donors.

Consideration of Design Modalities

At the design stage, *knowledge and information* informed the design of interventions. Thorough investigation of the problem and its causes, international best practice and extensive consultation informed and shaped the design of supplementation and fortification programs in all three countries. Although informed by international knowledge and information, the vehicles chosen for fortification differed. In Malawi and Zambia, the choice of sugar for vitamin A fortification was strongly influenced by commercial interests although the technical process and standards were informed by international knowledge and information. South Africa's decision not to fortify sugar was negatively influenced by knowledge and information about sugar consumption and its effect on human and oral health.

Norms, biases, ideologies and beliefs did not play a significant role in the design of micronutrient policies and programs in the three countries, except for three instances. First, prior to the apartheid era in South Africa, nutrition policy only focused on areas where such instruments supported the economic development of the farming and mining sectors of the Union. The transition to democracy in 1994 changed this and population-wide policies and programs were implemented. Second, a South African food company with major investments in maize milling decided to champion

maize fortified with B vitamins in the 1970s. It launched its fortified maize meal with a new brand name. Unscrupulous members of certain competitor companies spread the rumor that the new brand of maize meal caused male infertility, which negatively affected marketing. However, the brand survived this bad publicity. The commitment of companies willing to champion niacin- and riboflavin-fortified maize meal caused the successful integration of B vitamins into the multi-mix in later years. Third, beliefs emerged in the Zambian case, but not so much related to the design phase but as a complete aborting of the maize fortification proposal due to objections were raised by the political leaders at Statehouse. These related to concerns about national security and food safety, that mandatory standards would prevent rapid emergency imports of maize meal from outside of Zambia and rumors and perceptions of a possible negative impact on fertility.

Cost-benefit calculations have been one of the contentious issues in discussions raised by the sugar industry in Malawi and Zambia, even though the costs of fortification amount to one or two cents per unit for sugar and between 2 and 9 cents per child per year for fortifying salt with iodine. *Cost benefit analysis* did not present strongly in the South African fortification deliberations, except that studies were conducted to determine the cheapest and easiest product to fortify.

In micronutrient policy design, the technical elements related to stability of the nutrients in processing, storage, distribution and food preparation is of greater importance. Despite national roll out of supplementation programs through national health systems and schools distributing iron to teenage girls in Malawi and Zambia, the expected reductions in deficiencies have not been realized. This is largely attributed to issues of coverage, access and in South Africa, stock outs. There are challenges with regard to distribution logistics and the commitment of staff to administer the supplements. In Malawi, supplementation was deemed unsustainable without donor support and advocates of fortification felt that that supplements covered only the vulnerable population of pregnant women, lactating mothers, and children under five years of age, while other segments of the population also suffered from vitamin A deficiency. These proponents favored the population-wide approach of fortification.

Transforming Proposals into Adopted Policies

While powerful *proponents* play a crucial role in getting the issue on the agenda, *powerful opponents* were more evident in the adoption phase in nutrition policy. The same international agencies active in the agenda setting stage provided technical support throughout the process. In all three countries, once the benefits of supplementation and salt iodization were clear, their adoption was generally straightforward and unopposed. The *powerful opponents against fortification* were generally from the commercial sugar and milling sectors. In the case of sugar, several groups were opposed to fortifying sugar with vitamin A in all three countries but for different reasons in the three countries.

While *implementing veto players* are not evident in supplementation programs and iodine fortification, their voice is clearer in the case of other fortification programs. Veto players are the set of individuals or institutions whose concurrence is needed for a policy to move forward (see Tsebelis 2002). The Zambian President was a powerful *veto player*, instructing that all work on the maize meal fortification standards stop.

The private sector were the main opposition forces in fortifying sugar with vitamin A in all three countries, supported in South Africa by health professionals. In Zambia, UNICEF was instrumental in overcoming the resistance of the Minister of Agriculture who sided with sugar manufacturing company, blocking the vitamin A fortification mandate. UNICEF's heavy lobbying and the president's positive veto power helped in shifting the fortification program into implementation. Some opponents lobbied that South Africa should not implement blanket vitamin A supplementation because of possible megadoese toxicity. Although the proponents were stronger than the opponents, the opponents were successful in convincing their own provincial government (Western Cape) that blanket vitamin A supplementation was not necessary. Therefore, the roll out of vitamin A in the Western Cape Province, only started in 2005. The South African Chamber of Milling were concerned that fortification would increase production costs. They also wanted assurance that fortification would not have an impact on the organoleptic or performance characteristics of their product. Likewise, several major millers objected to mandatory fortification of maize meal in Zambia on the grounds that it would increase their costs, it might affect taste and it would likely put the large millers at a competitive disadvantage over small and neighborhood hammer mills. Large-scale opposition to sugar fortification in Zambia emerged only later, after adoption of the policy and consumer groups and competition watchdogs complained about high sugar prices.

The transition to a democratic government was *propitious timing* for nutrition policy in South Africa. At this time, many factors and events produced an opportunity to get focus and traction on nutrition interventions, and in particular, micronutrient interventions.

Ensuring Implementation Occurs on the Ground

Translating policies into programs requires four key elements. Most importantly, the *requisite budget allocations* are necessary. Micronutrient supplementation programs in Malawi and Zambia still largely depend on donor resources. Fortification programs have been well resourced by donors in all three countries during the start-up phase, but the costs of fortification in all three countries has been transferred to the private sector. Except that there is still donor support related to equipment, facilities and training to monitor compliance with regard to nutrient levels in fortified products in Malawi and Zambia and for evaluation surveys in all three countries.

Institutional capacity to implement micronutrient programs limits the coverage and efficacy of these programs. The *institutional capacity* to supplement exists at both municipal clinic level and during the child health weeks. However, the translation of priorities at the level of health care providers is weak. Regular stock-outs of essential vitamins at antenatal clinics, in particular, undermine the goals of nutrition at critical stages of the life cycle.

Given that the private sector has absorbed the cost of fortification and that fortification is mandatory, *requisite budgetary allocations* should not hinder fortification *per se*. However, compliance monitoring is not regulated and is weak owing to a lack of human resources to collect samples and the lack of skilled personnel to conduct the testing and analysis. Self-regulation of salt is expected in all three countries as well as the fortification of maize and wheat in South Africa. In Malawi and Zambia, monitoring of compliance of foods other than salt are financed by international donors. Although large millers in South Africa are able to absorb the compliance and capacity-building costs, small mills lack technical knowledge and capacity. In Malawi, school children are encouraged to bring salt samples to school for testing by Food and Hygiene Officers.

Sample collection is the responsibility of port officials and environmental health practitioners in Malawi and Zambia. However, due to heavy workloads, samples were not routinely collected. In Malawi and Zambia, the laboratory staff who conduct the tests do not have the necessary training to analyze the samples when provided. In South Africa, one of the two testing laboratories for iodine was closed due to institutional restructuring. Monitoring is not systematic and the supply of the testing equipment, funds

for traveling to retail stores and regular reporting of the monitoring results to the headquarters remains a challenge.

Porous borders, the distribution of products not intended for home consumption and the re-packaging of products for industrial use reduce the reach of fortified products and compromise nutrition. There are also concerns that populations in remote areas do not consume adequate quantities of fortified products to significantly improve their dietary intakes.

Implementation veto players are the designated implementers -- from the private sector, NGO or local agencies -- who have both the incentives and willingness to implement a policy program (Resnick *et al.*, 2017). Both micronutrient supplementation programs and fortification rely on the coordinated efforts of multiple players. Supplementation programs depend on donors for the provision of micronutrient supplies in Malawi and Zambia and the government in South Africa. International agencies -- notably UNICEF and USAID supported supplementation through district health offices, voluntary health workers and existing logistical mechanisms in the Departments of Health for implementation. This regular distribution is supplemented -- especially for vitamin A -- through child health days. Additionally, the District Commissioner's involvement in implementation and monitoring, working closely with the District Health Officers, has a major role in the process. Recently, the SUN movement has provided additional momentum through mobilization of donor funding for this purpose in Malawi and Zambia.

The private sector and food processors import and distribute fortified foods through regular marketing channels. Port Health Officers (PHO) and Food and Hygiene Officers (FHO) play a major role in monitoring fortification levels at the port of entry and at retail markets in the districts. The Malawian and Zambian governments depend on donor support to help with the development of infrastructure, testing equipment, training of staff at various levels, and for conducting specific studies to monitor the consumption of fortified foods. The South African commercial sector is responsible for monitoring fortification levels, while governments enforce legislation. Government Bureaus of Standards are responsible for specification and implementation of fortification standards.

The momentum for implementation often depends on the on-going *commitment of policy champions*, which typically refers to high-level bureaucrats or political leaders that sustain program momentum even when others' attention might fade (Resnick *et al.*, 2017). In contrast to the initial coordinated and focused advocacy of the agenda setting stage, the role of high-level bureaucrats and political leaders has not been evident in the implementation stage of the

micronutrient policy process in the three countries. The support of international partners, especially UNICEF and USAID has continued, even in South Africa where financial support is no longer provided.

Evaluating, Re-considering, and Reforming

The efficacy of the current programs is not ideal and the pace of change is too slow to achieve international and national goals. With more recent attention to the imperatives to address nutrition, research outcomes have led to *changing information and beliefs* with regard to the recommended levels of supplementation for iodine and vitamin A, protocols for administration the type of iron used in fortification of flours in South Africa and the administration of high doses of iron in malaria-infested areas.

South Africa consistently evaluates and reforms policy interventions. Research findings often play a major role in re-evaluating program design. For example, in the case of vitamin A, a 2005 study determined that vitamin A supplementation was not reaching children in the 12- to 24-month old cohort. In response, the government established child health weeks to increase coverage. Similarly, routine post-partum vitamin A supplementation was stopped in August 2012, due to a change in WHO guidance. The form of iron and required levels in South Africa's fortification program were initially established according to WHO guidelines at the time of implementation. Electrolytic iron was chosen as the form of choice. However, the WHO later increased its recommended micronutrient levels and recommended using a different type of iron to the electrolytic iron used in the South African program. In 2010, GAIN funded a national study to monitor fortification compliance of maize meal and bread flour. The study found that the level of compliance was low and notable dosage differences were found. An auditing program was initiated in 2014, with each miller responsible for auditing the dosage of multi-mix added to each batch of maize meal or bread flour produced. Due to the findings of a 2013 national survey, government has proposed the fortification of cake flour. The draft Bill was released for public comment in March 2016.

The 2011 Zambian iodine deficiency monitoring survey, like other countries in Eastern and Southern Africa, observed excessive iodine intake has been observed. Ongoing outreach efforts focus on encouraging local salt producers to iodize local production and with major importers to monitor newly reduced fortification levels. Recently Malawi and Zambia reduced the mandated levels of iodine for salt fortification, but South Africa widened the band of acceptable ranges.

The findings of the 2006 Tanzania Pemba study (Sazawal et al. 2006), has led to the reconsideration of universal iron and folic acid supplementation programs in high-malaria zones and renewed interest in strategies to improve iron intakes through food fortification (focused particularly on maize meal), diet diversification and bio-fortification.

Changing material conditions have not particularly affected the implementation of fortification programs due to the transfer of responsibility for funding these programs to the private sector. However, monitoring and evaluation programs are compromised by financial constraints. In terms of supplementation, budgetary resources constraints affect stocks and supplies of supplements and coverage are affected but have not changed the decision to implement supplementation programs.

Institutional shifts seldom influenced the micronutrient policies investigated, except for South Africa's transition to a democracy in 1994 and a series of cross-ministerial institutional reforms in Malawi (most notably with the creation of Malawi's Department of Nutrition and HIV and AIDS (DNHA) at the Office of the President, which afforded nutrition advocates unprecedented visibility and political access).

Conclusions and Broader Implications

The analysis of the three country cases reveals that while not all 16 variables embedded within the Kaleidoscope Model are relevant for explaining all policy reform episodes in nutrition, they do constitute the maximum set of factors that policymakers and researchers should consider when trying to identify opportunities for, or constraints to, policy reform. Malnutrition is a recognized, relevant problem with increasing international attention since the World Summit on Children in 1990 and has been supported by a number of high profile global focusing events and international publications. This has created momentum for powerful international and local advocates to initiate discussions on in the three countries. Data from national surveys and localized studies provided convincing evidence of the prevalence of significant public health-related issues. In the agenda setting stages in the 1990s and early 2000s, high-level local champions pushed for compliance with binding international commitments to reducing micronutrient deficiencies. Their efforts were supported by coalitions of international agents (including donors and UN agencies), NGOs and local researchers.

Despite the commonalities in the agenda-setting phase of the policy processes for micronutrients, distinctly different sets of stakeholders and context-specific considerations in the design (especially around funding mechanisms), adoption, implementation and evaluation phases of the

policy cycles for supplementation and fortification policies took different approaches.

Off-the shelf options provided existing solutions and evidence of their effectiveness in addressing micronutrient deficiencies. However, countries weighed up the body of experience and evidence and did not always come to the same conclusions. For example, Malawi and Zambia chose sugar as a fortification vehicle for vitamin A based on evidence from Guatemala, while South Africa decided against fortifying sugar and based their choice of maize and wheat on the experience of Venezuela. The lack of national distributions systems for maize and wheat flour in Malawi and Zambia as well as heavy lobbying and promotion of sugar fortification by key donors (UNICEF and USAID), influenced the choice of sugar as the vehicle for vitamin A fortification. In contrast, in South Africa, where donors hold less sway, policy makers came to very different conclusions about the optimal food vehicles for fortification. Malawi subsequently gazette a number of fortified foods in 2015. Cost-benefit calculations were less evident constraints to supplementation programs that were largely supported by donors in the initial stages but are now embedded in national health delivery systems. Cost-benefit concerns were more of an issue to private sector players in the fortification debates. Much of the initial opposition was unfounded, with international evidence indicating that the unit price of fortified foods should not be more than a few cents.

Powerful advocates and alliances made use of propitious timing in the 1990s to implement a number of micronutrient policies, during a time of significant policy change. All three countries used the momentum of global interest in nutrition and regular reports and feedback on progress towards the realization of children's rights to move policy decisions into adoption and action. In all three countries, once the benefits of supplementation and salt iodization were clear, their adoption was generally straightforward and unopposed. However, commercial interest played a significant role in the adoption phase of fortification, primarily because the industry was to bear the cost of fortification. The only case of a government veto player was found with the Zambian President's instructions to stop work on fortification of maize in Zambia.

The commitment of policy champions was less evident in the implementation stage. Implementation of both supplementation and fortification programs is dependent on a number of stakeholders working together in coordinated ways. These players are distinctly different in supplementation programs delivered through national health systems and fortification programs implemented through commercial millers. In some cases the cost of monitoring and compliance is also transferred to the private

sector. This differentiation between supplementation and fortification affects the resourcing of the programs and is influenced by the institutional capacity of the health systems for monitoring the coverage of supplementation programs and compliance in fortification programs. The quality of delivery and coverage of supplementation programs are severely dependent and constrained by budgets, institutional capacity and monitoring and compliance constraints during implementation. Likewise, fortification compliance systems are severely constrained by budgets, but do not seem to play a significant role at the design stage.

While changing information and beliefs demand continual evaluation and reform of micronutrient programs, changing material conditions and institutional shifts seem to have little influence on the policy process. Shifting the costs and responsibility for fortification to the private sector seeks to ensure the sustainability of fortification programs. Supplementation programs are still supported by donors in Malawi and Zambia, and delivery in all three countries is constrained by the inherent weakness of the health systems and access to health care facilities by target groups. Global attention to nutrition has led to renewed investment in research. This has led to new guidance from WHO regarding the administration of vitamin A to post-partum women, concerns over administration of mega-doses vitamin A and iron (in malaria areas) and excessive urinary iodine levels. Countries have responded to changes in international protocols for these micronutrients, adjusting standards and national protocols. The discussions are on-going and research continues to inform practice, leading to policy change.

While iodine programs have successfully reduced the incidence of deficiency, there is little evidence of the effectiveness of the combined interventions of supplementation and fortification of sugar with vitamin A in Malawi and Zambia. The improvements in South Africa have been attributed largely to the multi-mix fortification of maize and wheat flours, so much so that the government has proposed the expansion of fortification to cake flour to further improve the intake of a core set of vitamins and minerals by the population in general. Evidence of the effectiveness on improving nutrition through the fortification of various foods in Malawi is not available.

Unacceptably high levels of iron deficiencies persist, raising concerns that the current approaches to supplementation are not effective in reducing iron deficiency and anemia. Even in South Africa, the multi-mix that contains iron is not enough to make a significant difference in overcoming deficiencies of this mineral. South Africa is exploring changing the form of iron included in the multi-mix, in line with revised WHO recommendations. Increasingly,

attention to alternative food-based approaches is emerging on the policy agenda. Recent global attention to biofortification is likely to influence the integration of more such approaches into national agriculture, food security and nutrition policies.

In conclusion, the role of international attention, focusing events and guidelines on best practice are essential in initiating national policy reform in nutrition. Sustaining the momentum is dependent on donor support, coordination of a wide range of stakeholders and implementing partners, including the private sector. Due to nutrition being a public health issue, recognition of this sets in motion policy change. Credible evidence and knowledge is crucial to all elements of the cycle.

The Kaleidoscope Model demonstrates how policy change occurs with regard to nutrition, offering a tool to support the integration of nutrition elements into broader agriculture and food security policies. The model provides a guide to governments, researchers, international agencies and researchers regarding the entry points for policy change as well as providing insight into the key considerations to move the process through the design, adoption, implementation and evaluation stages to initiate on-going cycles of change.

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