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Priority areas for reducing stunting in South Africa:

Examining the implications of recent international evidence

Ronelle Burger, Lisanne du Plessis, Trust Gangaidzo and Gabrielle Wills[1]

Abstract

This working paper summarises and discusses the most recent and best available international evidence on stunting. Our aim is to inform and guide the public debate, the advocacy of non-profit organisations (NPOs), and the policymaking responses of the government as they grapple with South Africa's deepening food insecurity and stunting crisis. We first discuss the underlying causes of stunting, namely nadequate dietary intake, repeated infections, social and cognitive under-stimulation, and air pollution. Then through a review of the evidence, we focus on short to medium term interventions to reduce stunting targeted at children of the complementary feeding age of 6 to 24 months. This age group falls within the crucial and highly sensitive first 1000-day period and is a challenging feeding transition because breastmilk alone is no longer enough to sustain the child from six months onwards. A stock-take of the evidence, weighed against local contextual needs, leads us to two key recommended interventions for this complementary feeding age group: first, nutrition education for the community and caregivers with a focus on appropriate complementary feeding practices, and, second, the prescription and promotion of Lipid Nutrient Supplements in Small Quantities (LNS-SQ) - a high-energy fortified food for at-risk young children. We also highlight the importance of supporting policies and regulations to curtail the advertising of unhealthy food choices, promote the wider availability of healthy foods and develop better routine data on child nutrition and growth outcomes. While primary health care clinics are the most suitable nodes to reach mothers and very young children with interventions, we note that early childhood care or educational (ECCE) programmes have an important role to play in supporting such policies – both directly, through social and cognitive stimulation and better feeding, and potentially indirectly, by serving as champions, promoters and community-based contact points for complementary feeding education and nutritional supplements. Improved service delivery —with a focus on water, sanitation and hygiene (WASH), environmental management and health care reform— are also vital in tackling underlying causes of stunting. Routine data on breastfeeding, vitamin deficiencies, wasting, underweight and stunting is urgently needed to assess whether the recommended nutrition strategies are working and having the envisaged widespread impact on child growth and development. Beyond nutrition-specific interventions, more research is needed on how interventions to limit repeated infections, social and cognitive under-stimulation, and air pollution could alleviate stunting issues..

1 We thank Tafwirapo Chichana and Tankiso Lefeta for their excellent research assistance.

Introduction: Outlining the problem

In South Africa, one in four children under five are stunted (NDoH, Stats SA, SAMRC & ICF, 2019). Despite being a higher middle income country, South Africa ranks as one of the 34 countries accounting for 90% of the world's stunted children — alongside some of the poorest countries in the world such as Mozambique, Afghanistan and the Democratic Republic of Congo (Galasso & Wagstaff, 2019).

The term 'stunting' refers to children being short for their age,[2] but the problem encompasses much more than simply short stature. Identified by low height-for-age, stunting is a significant indicator of child development more broadly including cognitive and social development (Prendergast & Humphrey, 2014). We can think of stunting intuitively as a measure of unfulfilled or unrealised potential (Black, et al., 2013; Hoddinott, et al., 2013).

Stunting matters because it has a substantial and enduring social impact. It has been shown that growth deficits occurring at a young age tend to have a long-term impact on cognitive and social development, which in turn affects labour market prospects and earnings as an adult (Almond, Currie & Duque, 2018; McGovern et al., 2017). Stunting has relevance for inequality and social justice because it can function as a poverty trap, further entrenching patterns of vulnerability and privilege. By example, two and a half decades after the end of apartheid we find that in South Africa a child born in the rural village of Mqanduli in the Eastern Cape is more likely to be stunted than a child born in an affluent suburb like Hyde Park in Gauteng or Bishopscourt in Cape Town, and a double orphan is more likely to be stunted than a child living with two parents (Bridgman & Von Fintel, 2022). Research shows that the impact of stunting is long-term and without intervention can become intergenerational: a premature or low birthweight baby born of a malnourished mother has a higher risk of dying in infancy. If the baby survives, there is a risk of developmental and health problems throughout childhood and into adult life. Undernutrition has therefore been described as "not only one of the key manifestations of poverty, but … also one of the key mechanisms by which poverty – and its consequences – are transmitted intergenerationally" (Nisbett, Gillespie, Haddad & Harris. 2014 : 421).

Despite the introduction and expansion of the child support grant (CSG)[3] and widespread government and civil society efforts to address the causes of stunting, via for instance improved sanitation and access to clean water, there has been no progress in reducing stunting levels in South Africa over at least four decades (Devereux, 2017; NDoH, Stats SA, SAMRC, and ICF, 2019; Said-Mohamed et al., 2015). Local civil society groups are concerned that stunting may have worsened during the COVID-19 pandemic due to the resultant job losses, hardship and disruption of food production and transport. Since the pandemic hit South Africa, there has been widespread concern about hunger and food insecurity based on vivid anecdotal accounts of extreme hunger in the media and rapid-survey evidence of increased self-reported hunger since the pandemic. Global data shows that food insecurity has worsened since the pandemic, adding 118 million hungry individuals to the existing burden (UN & WHO, 2021). In response to this setback, the UN and the WHO emphasised the importance of remaining committed to the Sustainable Development Goal of ending hunger, food insecurity and malnutrition by prioritising food security and nutrition interventions. Continued increases in food prices due to, among other things, the Russian invasion of Ukraine may put further pressure on nutrition and cause more stunting (Madubela, 2022; Stats SA, 2022).

2 Children are referred to as stunted if their height is more than two standard deviations below the WHO Child Growth Standards median height for children of their age and gender (De Onis & Branca, 2016). The Standards' median height values were generated from a sample of 8440 children from diverse affluent backgrounds (Brazil, Ghana, India, Norway, Oman and the USA) (WHO Multicentre Growth Reference Study Group, 2006).

3 One would have expected the child support grant to have at least a marginal impact, though it would be unrealistic to expect it to eradicate hunger and stunting. Devereux and Waidler (2017) showed that although the grant may have had some effect, the allocated amount is not large enough to meet food needs and eradicate hunger in beneficiary households. It should, however, be borne in mind that for complementary feeding the amounts required are more modest as children of this age (6–23 months) need to consume only 200 to 550 kcal from complementary foods per day (WHO, 2002). A study investigating the affordability of key sources of nutrients for children of complementary feeding age showed that iron and calcium deficiencies, but not vitamin A deficiencies, among South African children of this age group may be attributable to affordability constraints (Ryckman, et al., 2021).

Motivated by this call to action, this working paper summarises and discusses the most recent and best available international evidence on stunting. Our aim is to inform and guide the public debate, the advocacy of non-profit organisations (NPOs), and the policymaking responses of the government as they grapple with South Africa's deepening food insecurity and stunting crisis. We document existing evidence to provide a starting point for assessing and debating context-appropriate solutions to reduce the stubbornly high levels of stunting in South Africa.

Because we want the working paper to provide a credible and sufficiently thorough overview of what is known about nutrition interventions and because we are aware of the wealth of available literature on this topic, we decided to focus on complementary feeding interventions,[4] which tend to target children aged 6 to 24 months. This age group falls within the crucial and highly sensitive first 1000-day period and is a challenging feeding transition because breastmilk alone is no longer enough to sustain the child from six months onwards. Many caregivers struggle to introduce other foods and liquids in their children's diets because the food available is inadequate in quantity, nutritional quality and variety. In low and middle income countries (LMICs) this complementary feeding age is the period when stunting is most likely to occur. Stunting is difficult to reverse after the age of two (Dewey & Adu-Afarwuah, 2008).

To ensure the credibility and prudence of our recommendations, we include studies in our review of the evidence only if they consider causation (and not correlation), have been carefully designed, are methodologically sound, and have been peer reviewed and published. We therefore exclude studies, reports and working papers that examine correlations but not causation.

In reaching mothers and young children (aged 0-24 months) with stunting related interventions, the network of South African public primary healthcare clinics would be a logical starting point due to high vaccination rates for this age group. In this working paper we ask whether the network of formal and informal early childhood care or educational institutions can play a complementary role, supporting stunting interventions and extending the reach of such interventions. These institutions have a clear and obvious role in combating social and cognitive under-stimulation and stunting. But they can have another more indirect role: they can serve as champions and promoters of better nutrition within communities. To achieve a substantial reduction in stunting, interventions would need to be implemented effectively at scale and achieve high levels of coverage within communities. This can be achieved when interventions are implemented via existing organisations with national coverage and deep reach into communities, such as the public network of primary health care facilities and the growing network of ECCE institutions. Public clinics have close to universal coverage of children at the age when they are receiving immunisations, but coverage declines thereafter. By contrast, the ECCE sector's coverage of children rises with age: approximately one out of every six children under one attends an ECCE institution. The most common form of ECCE institution care for children under 12 months is a 'day-mother', '*gogo*'[5] or childminder, followed by a crèche or educare centre. Coverage is just under 30% for children between one and two, 40% for children between two and three and close to 80% for children of four and five.[6] However, in principle a community-based organisation's reach with an intervention can exceed the client base, as has been demonstrated by initiatives that designate churches and spaza shops as community-based medication collection points to promote adherence through increased convenience. Based on the available estimates for ECCE programmes, they likely outnumber the public primary health facilities by a factor of at

4 Complementary feeding is the introduction of safe and nutritionally rich foods to infants aged 6 to 24 months to meet their nutritional requirements (Imdad et al., 2011; Pan American Health Organization, 2003). The term 'complementary' implicitly refers to the recommendation that a child should be exclusively breastfed up to the age of six months. Viewed more broadly, the 6 to 24 months period marks the transition from a milk-based diet to including a wider range of foods to complement the infant's milk intake.

5 Directly translated 'gogo' means grandmother in Zulu, but in this context it is used to refer to an older women who acts as a caregiver to children.

6 The 2030 targets set in South Africa's National Development Plan (NDP) specify that two years of quality preschool enrolment for four- and five-year-olds should be compulsory before Grade 1. Before the Covid19 pandemic South Africa was edging towards these universal targets (NDP 2011:300). Seventy-eight percent of children aged four to five years attended an ECCE institution, including Grade R, pre-school or nursery school or Grade 00 or Grade 000, crèche or educare centre, or day-mother or 'gogo' or childminder, home or community playgroup, other or school.

least fifteen[7], which demonstrates why they might serve as an effective base for community-based nutrition interventions and facilitate better coverage and a deeper reach into communities.

The working paper has three parts. The first describes the four main direct causes of stunting: inadequate nutrition, repeated infections, social and cognitive under-stimulation and air pollution. The second examines the evidence on nutrition interventions in LMICs that have robustly yielded significant reductions in stunting for the 6 to 24 month age group. It looks at macro and micronutrient interventions, complementary feeding education, income support, water, sanitation and hygiene (WASH), and food environment and food security. The focus is on affordable solutions that can be rolled out rapidly and at scale in the South African social context, bearing in mind the fiscal and implementation constraints. The third recommends ways to address stunting and nutrition in South Africa in both the short and the medium term, taking into account fiscal, contextual (social, caregiving and food availability) and implementation constraints.

1. Direct causes of stunting in the South African social context

The WHO (2015) identifies three direct causes of stunting: inadequate quantity or quality of diet, repeated infections, and under-stimulation and lack of care. Recent evidence also shows a link between air pollution and stunting, which suggests that this should be added as a fourth cause. However, this literature is less well established and little is known about how air pollution affects stunting, especially in LMICs.

Most of the literature on predictors of stunting examines correlation and not causation, and is often weakened by the omission of numerous variables (Casale, Espi & Norris, 2018). The causal studies are dominated by RCTs (randomised controlled trials) and thus provide only a limited and narrow view. For instance, RCTs can tell us about how stunting is affected by specific supplements, but such studies provide little insight to aid our understanding of how a nutritious diet prevents stunting.

1.1. Inadequate nutrition

The commonly used term 'inadequate dietary intake' refers to insufficiency in either the quantity or quality of food, with quality referring specifically to food types containing nutrients that are needed to promote growth and development.

Infants and young children particularly need animal-source foods to grow and develop. Animal-source foods contain high quality nutrients and some vitamins and minerals are better absorbed from milk, meat and eggs than from plant-derived foods. Animal-source foods are the only foods that contain enough iron, zinc, calcium and riboflavin for complementary feeding, and they are also low in anti-nutrients[8] (Headey, Hirvonen & Hoddinott, 2018).

Inadequacies in the quantity and quality of food have been shown to cause growth to falter in the complementary feeding age group (Caulfield, Richard, Rivera, Musgrove & Black, 2002). To grow and develop, children require both macro and micronutrients (Colombo, Koletzko & Lampl, 2018). Macronutrients (proteins, carbohydrates and fats) are energy-providing nutrients that are required by the body for normal daily functioning. Micronutrients (vitamins and minerals) are consumed in smaller amounts than macronutrients but are critical for health, growth and development. Iron deficiency, for instance, is one of the most prevalent micro-nutrient deficiencies. It can reduce energy levels over

7 At the launch event of the ECD Census 2021, Janeli Kotze from the Department of Basic Education mentioned an estimate of 48,000 ECD centres, which also included unregistered centres (DBE, 2021). According to a 2020 press release by the Department of Social Development, "over 2 million children receive some form of ECD services. Of this number, 800,654 children are currently accessing registered ECD programmes by the Department of Social Development. Of these, 626,574 children receive a subsidy of R17 per child per day" (DSD, 2020).

8 Anti-nutrients are plant compounds inhibiting the absorption of nutrients. Phytate, tannins, protease inhibitors, calcium oxalate and lectins are the most important anti-nutrients and are found in seeds, grains and legumes. Anti-nutrients become a problem in cases where individuals experience malnutrition or have diets very high in grains and legumes.

the short term and cause stunting over the long term (Matsungo et al., 2017). Iron supplements have been shown to boost the cognitive test scores and grade progression of adolescents attending school (Chong et al., 2016; Walker et al., 2007) and increased the hourly income of adult workers (Thomas, et al., 2004). Zinc is also a crucial micronutrient, with zinc deficiencies being linked to frequent illness and also growth restriction (Ekweagwu, Agwu & Madukwe, 2008).

There is a strong intuitive association between hunger and stunting, so it is vital to emphasise that children who have enough to eat and do not experience hunger can still be at risk of stunting if their diet contains too few nutrients. This is often referred to as 'hidden hunger'.[9] Hidden hunger refers to cases where a micronutrient deficiency occurs without the person suffering from a shortage of calories or an empty stomach, which also implies that that there will be an absence of the visual cues associated with enduring calorie deprivation, such as a frail and thin body. In many South African households, children are fed stomach-filling foods like maize-based meals and sugar, which lack proteins and vital micronutrients like vitamins, zinc and iron (Faber, 2004; Faber & Wenhold, 2007; Ntila et al., 2017). To prevent stunting, children need to have adequate amounts of food, but also the nutrients vital for growth and development (Huffman & Martin, 1994; Otterbach & Rogan, 2019). Hidden hunger is associated with the increasing accessibility and affordability of processed foods. Such foods have also been blamed for obesity because of their calorie density but lack of nutrients. Children can be both obese and stunted when they consume more calories than they need but not the nutrients that their bodies and brains require to grow and develop (IFPRI, 2014; Wendelbo, 2018). This problem has spread to developing countries as the share of processed foods in their diets increased.

Recent studies show a strong association between diet quality and stunting. In a large share of young children in 49 LMICs, insufficient diet diversity was correlated with stunting (Baye & Kennedy, 2020). A pooled analysis of 39 Demographic and Health Surveys found that dietary diversity and animal source food consumption were negatively associated with stunting (Krasevec et al., 2017). Low-protein diets were associated with stunting in children from South Africa, Tanzania, Bangladesh, Nepal, India, Peru and Brazil (MAL-ED Network Investigators, 2017). Micronutrient deficiencies were found to be responsible for an increasing share of the stunting burden in South Africa (Misselhorn & Hendriks, 2017).

This does not mean, however, that insufficient quantity of food is no longer a problem. Poor households frequently suffer a double burden of malnutrition, with food being inadequate in both quality and quantity. For instance, in Richards Bay, Dundee, and Harrismith (three towns in KwaZulu-Natal, South Africa), food-insecure households often also suffered from poor dietary diversity (Chakona & Shackleton, 2018).

Studies suggest that in South Africa stunting is correlated with not having enough to eat, inadequate dietary diversity and poor nutritional knowledge (Dukhi, Sartorius & Taylor, 2017; Labadarios et al., 2000; Mkhize & Sibanda, 2020; Otterbach & Rogan, 2019).

The social context has a strong association with nutrition. In South Africa, many mothers are single, economically vulnerable, and did not continue studying after high school. Responding to the challenges of this child-rearing context, the Philani Maternal Child Health and Nutrition Programme[10] designed a 'mentor mother' package intervention that offers, among other things, micronutrient supplementation and stimulation to children, and advice on breastfeeding and feeding and nutrition to the mothers and caregivers. The intervention involves home visits by community health workers (mentor mothers) in addition to clinic-based (standard) antenatal and postnatal care. A series of results from an RCT has shown maternal and infant well-being to be better in the intervention group than in the group receiving standard care. A study based in the townships around Cape Town showed that after three months of the Philani Mentor Mother Programme, children in the intervention

9 The International Food Policy Research Institute's 2014 Hunger Index report was devoted to 'hidden hunger'. It is estimated that globally two billion people suffer from micronutrient deficiencies (Wendelbo, 2018).

10 This NPO addresses child health and nutrition problems in impoverished communities. It has been in operation since 1979.

group were more likely to have a healthy weight for their age (Le Roux, Le Roux, Comulada, Greco, Desmond, Mbewu & Rotheram-Borus, 2010).[11] A later study in the same area found that children in this Programme were less likely to be underweight for their age and less likely to be stunted than those in the control group (Tomlinson et al., 2016). The impact on stunting was, however, not clinically significant. Results from the Philani MOVIE RCT showed that interventions via videos (as opposed to face-to-face counselling) can be effective in improving infant feeding practices and maternal knowledge (Adam et al., 2021).

Nutritional deficiencies for the complementary feeding age group are also linked to low breastfeeding rates. Due to the complexity of the issues surrounding South Africa's low breastfeeding rates, we are considering this topic as beyond the scope of this working paper as we do not have enough space to discuss this topic in sufficient depth here. Appendix A1 briefly outlines low breastfeeding rates in South Africa.

1.2. Repeated infections

The association between repeated childhood infections and stunting is well-established. Acute childhood infections have long been linked to growth restriction (Black, 1991). Infection affects stunting by reducing appetite, lowering intestinal absorption, increasing catabolism,[12] and diverting nutrients towards immune response instead of growth and development (Stewart et al., 2013).

Three kinds of infection prominently involved in stunting are diarrhoeal infections, intestinal parasite infections (such as roundworm, whipworm and hookworm), and environmental enteric dysfunction (EED). Although malaria is a significant cause of stunting in the rest of Africa, its prevalence is still relatively low in South Africa, and we therefore do not discuss it here.

Diarrhoeal infection is the commonest cause of mortality for children under the age of five, accounting for nearly one in five child deaths in this age category (South African Health Review, 2018). The prevalence of diarrhoeal infections varies dramatically, depending on the season and the age of the child. In South Africa diarrhoea is mostly caused by bacterial or viral enteropathogens with a peak in the number of bacterial cases in the summer months and rotavirus cases in the winter (Awotiwon et al., 2016; Ikeda et al., 2019).

Studies have demonstrated the protective effect of exclusive breastfeeding against both morbidity and mortality from diarrhoea, particularly by reducing diarrhoeal stools and helping maintain hydration during diarrhoeal episodes (Huffman & Combest, 1990; Khin-Maung-U, et al., 1985). The lowered diarrhoeal risk from exclusive breastfeeding is in contrast to the risk of contamination due to preparing formula feeds with contaminated water or unsterilised bottles. Chola et al. (2015) note that inaccurate perceptions about the adequacy of exclusive breastfeeding can, however, increase the risk of diarrhoea. Mothers often fear that their breast milk is inadequate and supplement it by giving their babies water to drink, which increases the risk of diarrhoea from contaminated water (Goosen, McLachlan & Schübl, 2014). As expected, it has also been shown that the risk of diarrhoea increases when children start complementary feeding (Ogbo, et al, 2018).

Another important interaction to note is between nutritional deficiencies and infection risk. Nutritional deficiencies reduce children's immunity and increase their risk of infection, which retards their linear growth (ACC/SCN, 2001). Supplementation with micronutrients such as zinc and vitamin A helps to reduce both morbidity and mortality due to diarrhoea, dysentery, pneumonia, malaria and acute lower respiratory infections (Cuevas & Koyanagi, 2005; Sazawal et al., 1996). In their review of RCTs of preventive zinc supplementation, Yakoob et al. (2011) found that this supplementation reduced diarrhoea- and pneumonia-related morbidity and mortality among under-five children in

11 This study was unable to obtain reliable infant length and child height measurements because of the difficulty of obtaining these from respondents living in informal housing.

12 Catabolism refers to all reactions (chemical or enzymatic) involved in the breakdown of organic or inorganic materials such as proteins, sugars and fatty acids to generate energy (Shimizu, 2013).

developing countries. A review of six studies in Bangladesh, India, Peru and South Africa found that zinc supplementation significantly reduced the incidence of pneumonia in children aged 2 to 60 months (Lassi, Moin & Bhutta, 2016). In South Africa, a RCT examining the efficacy of adding zinc or zinc and multiple micronutrients to vitamin A supplementation in preventing diarrhoea found that this supplementation was more effective than vitamin A alone in reducing diarrhoea morbidity in stunted rural South African children (Chhagan et al., 2009). Vaivada, Gaffey and Bhutta (2017) found that Vitamin A supplementation successfully reduced child morbidities associated with vitamin A insufficiency, and also all-cause and diarrhoea-related mortality.

The likelihood of diarrhoeal infection is determined by the environment and particularly by insufficient or unclean water, inadequate sanitation and poor hygiene (WASH). When children do not have access to safe drinking water, toilets and hygiene, their health, nutritional status and physical growth suffer.. While access to piped water and adequate sanitation is less of a problem in South Africa than in other African countries,[13] the incidence of diarrhoea remains high. This may be at least partly explained by low levels of home hygiene (Keshav, et al., 2015). Evidence suggests that poor home hygiene is linked to knowledge and behaviour and has a weak relationship with formal housing, piped water and adequate sanitation (Keshav et al., 2015; Pickering et al., 2011; Sinclair & Gerba, 2010). We note that the WASH framework neglects the role of inadequate waste removal and sewerage in child health outcomes. In a review of studies on the effects of inadequate provision of water and sanitation on children's health, Bartlett (2003) found that child mortality rates in neighbourhoods with inadequate waste removal, drainage, piped water and sanitation were 10 to 20 times higher than the rates (around 10 per 1000 live births) in those with adequate provision. Khan, Fatima and Ali (2021) found that piped sewerage and flush to septic tanks reduced the odds of overweight and stunting among under-five children in Pakistan. Checkley et al. (2004) found that inadequate sewerage was associated with a 0.9cm height deficit for Peruvian two-year-olds. In areas with no or poor sewerage and waste removal, children are exposed to a risk of repeated infections from pathogens and parasites from open drains and flood water (Amin et al., 2020; Wang, et al., 2022).

Intestinal parasite infections are among the most prevalent infections that occur all over the world, especially in low-and middle-income countries. An estimated 3.5 billion individuals are affected, with 450 million, largely young children, being ill as a result (Mohammed Hamad et al., 2019). Worm infection is reported to be burdening many South African children and increasing healthcare costs.[14] The most vulnerable children are those living in densely populated and under-serviced urban informal settlements, as well as some rural areas (Fincham & Dhansay, 2006; Mohammed Hamad et al., 2019).

Nxasana et al. (2013) conducted a cross-sectional study to determine the prevalence of intestinal parasites among primary school children in Mthatha, South Africa, and to correlate this with their socioeconomic status. Stool samples from a sample of 162 pupils found that 64.8% tested positive for ova and cysts, 57.4% being known harmful parasites. Ascaris lumbricoides was the most prevalent, followed by Giardia lamblia and Entamoeba histolytica/dispar.[15] No statistically significant differences were found between urban and rural pupils, regardless of their sex or age. There were, however, significant correlations between parasitic illnesses and parental unemployment and low education. In a cross-sectional study of intestinal parasitic and bacterial infections related to diarrhoea in Vhembe district, Campylobacter *spp.* and Aeromonas were found to be the most common bacterial causes of diarrhoea and Entamoeba histolytica/dispar, Cryptosporidium, Giardia lamblia and Cyclospora the most common parasitic causes (Samie, Guerrant, Barrett, Bessong, Igumbor & Obi, 2009). The study sample consisted of 295 school children at two public primary schools and 528 patients at public hospitals.

13 The 2018 General Household Survey shows that 89% of households have access to piped water and 83% to improved sanitation (Stats SA, 2019b). Improved sanitation is defined as access to flush toilets that are connected either to a public sewerage system or a septic tank, or a pit toilet with a ventilation pipe (Stats SA, 2019b).

14 These infections can compromise nutritional status by causing internal bleeding, which can result in iron deficiency and anaemia; intestinal inflammation and obstruction; diarrhoea; and impairment of nutrient intake, digestion and absorption, among other things (WHO, 2019).

15 Also found, albeit at a lower frequency of occurrence, were Iodamoeba butschlii, Trichuris trichiura, Hymenolepis nana, Taenia spp., Chilomastix mesnili and Fasciola spp.

In some cases, intestinal parasites can be easily treated at low cost, with significant positive implications. Studies from a school-based deworming RCT conducted in a Kenyan western rural district between 1998 and 2001 suggest that there are short- and long-term benefits of deworming (see Box 1).

BOX 1: Deworming RCT

The deworming RCT was made up of 75 schools randomly assigned into three groups that all received treatment in a phased programme over four years from 1998 to 2001 (Ahuja et al., 2018; J-PAL, 2012). The children's baseline helminth infection rates were over 90%. Children in the treatment schools received deworming drugs twice a year and schistosomiasis (bilharzia) treatment once a year. Miguel and Kremer (2004) found there were large reductions (18 percentage points) in worm infections among not only treated but also untreated pupils in the treated schools and also (22 percentage points) among pupils from schools within a 3 km radius of the treated schools. School attendance and participation also improved for all three groups (Miguel & Kremer, 2004). Follow-up studies (for example Baird et al. (2016) and Ozier (2018)) showed that the intervention had a long-term effect on academic test scores. Twenty years after the original intervention, Hamory et al. (2020) found that individuals who received two to three additional years of childhood deworming earned 13% more per hour and were able to spend 14% more. The mass deworming treatment costs only 0.65 US cents (or approximately R1.00) per year per child.

Environmental enteric dysfunction (EED) (formerly known as 'environmental enteropathy') is a gut inflammation syndrome characterised by reduced absorptive capacity and barrier function in the small intestine. It is not yet well understood, but widespread in lower and middle income countries[16] and known to contribute to stunting, as well as reducing the efficacy of oral vaccines and increasing the risk of illness from infection (Crane, Jones & Berkley, 2015). We include it in this working paper because it gives a different perspective on why it has been so difficult to reduce stunting in LMICs and because it has implications for how we think about stunting interventions in these countries. EED is associated with the widespread poor sanitation, gut infection and micronutrient deficiencies in many communities in LMICs, but the syndrome is not easily eliminated as it needs to be addressed at a community level. This may help to explain the disappointingly slow progress in the fight against stunting, including particularly the lack of impact of WASH interventions because of randomised selection of households for treatment (Tickell et al., 2019). EED is frequently asymptomatic, but can be diagnosed with a dual sugar absorption test and has also been associated with a number of biomarkers. In terms of interventions, there is emerging evidence that antibiotics and omega-3 and multiple micronutrient supplementation have aided recovery from EED (Crane et al., 2015; Tickell et al., 2019).

1.3. Social and cognitive under-stimulation

Early life stunting is associated with inadequate stimulation, and most studies examinine the increased risk of stunting when children suffer not only under-nutrition but also under-stimulation (Aboud & Akhter, 2011; Barros & Ewerling, 2016; Daniels & Adair, 2004; Grantham-McGregor, 2002; Walker et al., 2007). The effect of nutritional deficiencies on a child's cognitive and psychosocial development depends on the quality of the child's environment (Galasso et al., 2017). Children from poor households and societies are exposed to socioeconomic and environmental risks that can impair cognitive and psychosocial development (Baker-Henningham & Boo, 2010; Wei et al., 2015).

16 Recent research has shown. for instance, that 39% of a sample of 539 children aged 18 months in rural Bangladesh had EED (Campbell et al., 2018) and 80% of a sample of 400 children aged 12 to 59 months in rural Malawi had EED (Semba et al., 2017).

Interaction between children in day-care centres and preschool provides some stimulation, but Galasso et al. (2017) find that early social and cognitive stimulation by mothers or caregivers, together with improved feeding practices, may help cushion the socioeconomic and environmental risks of cognitive and psychosocial development for children (Galasso et al., 2017). An Ethiopian study of foster children aged 3 to 59 months living in poor households found a larger impact on fine motor skills for children with lower baseline weight-for-height or weight-for-age standardised scores (Worku et al., 2018). Results from a time-lagged controlled study in Bangladesh showed that integrating psychosocial stimulation into the treatment of severely malnourished children and making home visits increased the impact of such interventions on these children's growth and development (Nahar et al., 2009).

Early childhood stimulation interventions were found to have both short-term and long-lasting impacts among stunted children (Thorsdottir, 2005). Cumulative evidence from a 1986–1987 randomised psychosocial stimulation trial in Kingston, Jamaica, found cumulative benefits of stimulation interventions. They found that stimulation narrowed the cognitive and socioemotional skills gap between the stunted children in the intervention group and the non-stunted children in the comparison group (Walker et al., 2005), and that the poor self-esteem, depressive symptoms and anxiety levels of stunted children in the intervention were similar to those of the non-stunted ones (Walker et al., 2007). A follow-up study to the trial showed that the stimulation intervention increased the study participants' earnings by 25% twenty years later (Gertler et al., 2013). A further follow-up study at age 31 showed that the treatment group had 37% higher earnings than the control group (Gertler et al., 2021). This increase in earnings reduced the earnings gap between the intervention group and the baseline non-stunted comparison group. Further, the results at age 31 showed that the treatment group participants (who received stimulation with or without nutrient supplementation) had significantly higher intelligence quotient (IQ), cognitive flexibility, grit, and conscientiousness and lower levels of depressive symptoms, and substance use than the participants receiving supplementation only but no stimulation (Walker et al., 2021).

Nutrition programmes complemented with cognitive stimulation achieve better results in children's development, though the effect may not be additive (Perkins et al., 2017; Yousafzai et al., 2014). According to Galasso et al. (2017), ECD, parenting, and psychosocial stimulation interventions paired with nutrition interventions may improve the results achieved by nutrition interventions, and may also reduce costs of running the two sets of interventions due to economies of scale and scope.

These studies show that stimulation can have a protective effect in terms of the long-term cognitive and labour market disadvantages experienced by individuals who were stunted as children. Similar to the way it is treated in the literature where it is positioned as an add-on to nutrition interventions, the working paper do not examine the stand-alone impact of stimulation interventions.

1.4. Air pollution

Sinharoy, Clasen and Martorell (2020) have shown that poor nutrition and environmental exposure to air pollution and infections can have a detrimental effect on immunological ontogeny, beginning in pregnancy and continuing throughout early life. Defects in innate and adaptive immune function may then contribute to the interplay of air pollution, infection, and malnutrition, culminating in a cycle of recurring disease and malnutrition, affecting gut barrier function and triggering chronic immune activation, local and systemic inflammation, and growth hormone resistance. The researchers also find that repeated exposure to air pollution can also affect lung structure and function, triggering a similar biological response to the effect of enteric pathogens on the gut. There is observational evidence showing that schoolchildren (mean age 7 years) who are exposed to high concentrations of air pollution, have chronic systemic inflammation. Proinflammatory cytokines can also systemically regulate growth by suppressing processes mediating the effect of growth hormones on bone growth.

Additionally, the researchers report that studies from France and India found that ambient air

pollution — measured as PM10, nitrogen dioxide, and haze scores — is associated with lower vitamin D concentrations in neonates and children 9–24 months old, which can increase young children's risk of respiratory infection and affect bone metabolism and growth.

Sinharoy, Clasen and Martorell (2020) map these plausible pathways whereby air pollution can cause stunting. However, they repeatedly mention that while it is known that exposure to harmful air pollution is high, especially in LMICs, the evidence on the causal link is weak.

There is some existing evidence on air pollution and birth weight. For instance, Currie and Walker (2011) showed that reduced vehicle emissions in the vicinity of toll plazas lowered the incidence of low birth weight by about 9 to 11% within a 2 km radius of the plazas. The difference-in-difference results also found that prematurity was reduced by approximately 7 to 9%. The study followed the introduction of electronic tolls in New Jersey and Pennsylvania, which reduced both traffic congestion and the local level of auto emissions. US evidence suggests that children born to less educated and minority mothers and in densely populated neighbourhoods are more likely to be exposed to pollution in utero (Currie & Walker, 2011). A literature review by Currie et al. (2014) also shows that air pollution has long-term effects on human capital outcomes through lowering of IQ scores, school grades, and years of education, and earnings.

2. Evidence on interventions aimed at decreasing stunting

This section draws primarily on the summary of evidence from the two latest Lancet maternal and child nutrition reviews in 2013 and 2021. These reviews are based on a number of systematic reviews of key topics and provide authoritative and evidence-based reviews of what works in nutrition. Heidekamp, et al. (2021, Supplementary Materials: 4) explains the threshold for study inclusion as "randomized controlled trials and non-randomized quasi-experimental studies such as controlled before-after studies, interrupted time series studies, natural experiments and regression discontinuity designs".

The papers in these series are relevant to this working paper not only because they focus on LMICs but also because they are based on systematic reviews. Systematic reviews require a large quantity of rigorous evidence (from RCTs and pseudo-randomised studies) covering comparable interventions. Such reviews therefore tend to focus on research that investigates proximate mechanisms rather than distal determinants (i.e. direct rather than indirect causes) and use relatively simple methods that are thus replicable and scalable. The systematic review method therefore has relevance for policy making. Systematic reviews provide the ideal basis for policy decisions and prioritisation because they bring transparency and rigour to the processing of contradictory findings from the literature. They comprehensively summarise current knowledge based on the high-quality (comparable) studies available at the time. In our working paper we cite both the review papers themselves (published in The Lancet) as well as the underlying systematic reviews and sometimes also specific studies mentioned by the systematic reviews. For topics outside of nutrition, we implement the same selection criteria as the Lancet review papers, focusing on well-executed and causal studies that provide strong evidence on what works.

The most authoratitive evidence on the impact of micronutrient supplementation in LMICs comes from the 2021 series. This series tracks progress in combating undernutrition since the 2013 series and draws on a number of updated systematic reviews on nutrition interventions in LMICs (Heidkamp et al., 2021). Because the 2021 series is an update, the 2013 series is useful as background. Significantly for this working paper, it included a widely cited article by Bhutta et al., 2013), which recommended a package of 10 nutrition-specific interventions based on systematic reviews of such interventions. The article and its recommended interventions attracted attention because the authors' calculations projected that these 10 interventions would reduce global stunting by 20% if implemented at scale in the 34 countries with the largest share of the global stunting burden. This set of 34 countries includes South Africa.

The Lancet series cover a wider age range than the 6 to 24 month age range we focus on in this working paper. However, six of the 10 recommended interventions pertain to the complementary feeding age group: breastfeeding promotion, vitamin A supplementation, zinc supplementation, nutritional education, food supplementation and acute malnutrition screening and treatment. We omit acute malnutrition screening and treatment from the evidence we review in this working paper because there is widespread consensus that this should be a priority strategy, but little guidance from the literature about how best to implement it. Our review thus focuses mainly on four of these 10 recommendations: vitamin A and zinc supplementation, nutritional education and food supplements. Besides referring to the Lancet series, in this section we also review some evidence from the international literature on other types of interventions for supporting nutrition, including WASH, and income and psychosocial interventions.

The literature covers a wide range of outcomes, including nutritional deficiencies, child physical development such as height and weight, child cognitive development, and morbidity and mortality. While our focus is on stunting, we report on a wider set of outcomes because there are many factors involved in stunting: we may be able to see that an intervention has improved a necessary condition for child growth and development, but not isolate the effect it had on stunting. We looked only at studies that examine the causal relationship, i.e. randomised control trials, quasi-experimental studies and systematic reviews of such evidence.

In the following sections we look at five topics: macro and micronutrient supplementation and fortification, complementary feeding promotion and education, income support, food environment and food security, and WASH (water, sanitation and hygiene).

2.1. Macro and micronutrient supplementation and fortification

This section reviews evidence on the benefits of macro and micronutrient supplementation and fortification during the complementary feeding stage. Studies have examined the impact of either one specific micronutrient (such as iron, zinc, iodine or vitamin A) or multiple micronutrients (MMN) or a combination of macro and micronutrients.

Many studies include iron with other micronutrients, either because products with multiple micronutrients rarely exclude iron or because studies on looking at how to boost iron in iron-deficient populations tend to also include other micronutrients. Supplementation with vitamins A and C aids the absorption of iron (Bhargava, 2015), and vitamin B12 is included in anaemia treatments for iron-deficient diets (Stabler & Allen, 2004).

BOX 2: Approaches to macronutrient and micronutrient supplementation

For the complementary feeding age group, the strategies for micronutrient supplementation, include multiple-micronutrient tablets (crushed into food), micronutrient powders (MNPs) added to meals, macro and micronutrient containing ready-to-use therapeutic foods (RUTFs),[17] and fortified foods (such as micronutrient-enriched staple foods like maize meal porridge or bread baked with fortified flour). Importantly, the category of RUTF includes small-quantity lipid-based nutrient supplementation (LNS-SQ) such as the 20 g NutriButter sachet, a peanut butter-based micronutrient supplement for complementary feeding age children which provides various micronutrients and 110 kcal of energy (450 kcal being the daily requirement at complementary feeding age).[18] Although LNS-SQ products were originally developed to treat severe malnutrition, the small quantity products (20 to 50 g/day) are distinct from their predecessors. The SQ product is intended to prevent wasting and stunting.

17 RUTFs usually contain a standard set of energy-rich ingredients such as milk powder, sugar, vegetable oil and milk as well as nutritional supplements such as minerals and vitamins (Schoonees et al., 2019).

18 Lipids are substances that cannot be dissolved in water, but can be dissolved in chloroform, ether or alcohol. The term is commonly used to refer to oils and fats.

The quantity has been reduced to ensure that it does not displace breastfeeding, leaves room for other foods and can be used for home fortification of local foods (Dewey & Arimond, 2012). In trials, the researchers accompanied the provision of supplements with appropriate messages about the use and storage of LNS-SQ and also provided general guidelines for feeding infants and young children, including advice on breastfeeding, dietary diversity and nutrient-rich foods (Dewey et al., 2021).

The first crucial consideration is whether interventions aimed at the general population are long, medium or short term strategies. For the general population and in the medium term, the food fortification[19] mandated by the government would be the recommended strategy for increasing the dietary intake of specific micronutrients (Tam et al, 2020). However, safety regulations dictate that fortification of food cannot exceed the tolerable upper intake level for an adult, so the small quantity consumed by young children would not meet their daily needs. Supplementation is an important short-term intervention particularly for the complementary feeding age and for at-risk groups. Supplements targeted at complementary feeding age children are designed so that a single dose meets their daily micronutrient needs (Tam, et al, 2020). Dietary diversification is a long-term strategy that requires behaviour change, whereas supplementation and fortification do not require the target group to change their behaviour.

An important consideration influencing the choice of supplementation and fortification is whether recipients can do the further preparation. Micronutrient powders (MNPs), for instance, need to be added to water or food and some fortified foods may need to be cooked before they can be consumed. In the context of emergency relief for remote communities without reliable access to energy and clean water, it would often be prudent to distribute supplements that require no further preparation, such as a RUTF that can be consumed from the sachet. Shelf life can also be a consideration. Both MNPs and RUTFs tend to have a long shelf-life and do not need to be refrigerated, and this is rarely the case with fortified foods.

Decisions on the energy-density of the micronutrient supplement are determined by whether the target group is believed to be deprived of nutrients only or both nutrients and calories. It should, however, be noted that for the complementary age group there is also a risk of crowding out breastfeeding if the calorie content of the product is too high. In addition to breastmilk, a child 6 to 12 months old needs 200 to 300 calories per day from complementary foods. A supplement should not exceed this quantity, and ideally it should be lower to allow children to eat some home prepared meals as well (Dewey & Adu-Afarwuah, 2008).

Two of the six nutritional interventions recommended by Bhutta et al. (2013) for the complementary feeding age group relate to micronutrient supplementation: high-dose vitamin A supplement and zinc supplements. The evidence review did not find any evidence that vitamin A and zinc supplements had a consistently negative and statistically significant impact on stunting. Instead, the recommendations for vitamin A and zinc supplements were based on the impact of vitamin A supplementation on reduced mortality and lower incidence of diarrhoea and measles for children between six months and five years of age and the impact of zinc supplementation on mean height, linear growth, reduced incidence of diarrhoea and pneumonia in children younger than five (Bhutta et al., 2013; Imdad & Bhutta, 2011).

The 2021 Lancet updated systematic reviews confirmed the earlier findings on vitamin A, still showing consistent evidence that it reduced mortality and the incidence of diarrhoea and measles (Imdad et al., 2017). The updated reviews of zinc supplementation studies supported the earlier review findings that zinc supplementation consistently reduced the incidence of diarrhoea but no longer found a consistent impact on height or linear growth (Mayo-Wilson et al., 2014).

19 Since 2003 the South African government has been fortifying certain types of maize meal and wheat flour with vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc. Vitamin B12 was added later.

The most noteworthy update of the 2013 nutrition recommendations by the 2021 series is the expansion of the list of recommended nutrition interventions for the complementary feeding age group to include small quantity lipid-based nutrient supplements (LNS-SQ) with added micronutrients. These studies are part of a broader stream of literature considering the importance of lipids, and particularly essential fatty acids for child growth and development. Fatty acids regulate developmental and physiological processes and are vital for early growth and development (Xiang & Zetterstrom, 1999. Huffman, Harika, Eilaner & Osendarp, 2011).

Experimental studies showed that when LNS-SQ is used as a daily point-of-use fortificant for complementary foods it consistently reduces severe and moderate wasting, underweight, stunting, anaemia and mortality for the complementary feeding age group (Das et al., 2019; Stewart et al., 2020). Figure 1a below shows the findings from the meta-analyses of recent LMIC evidence conducted by Tam et al. (2020), in which only LNS had a robust impact on stunting. Other interventions such as zinc and iron supplementation and MNP had risk ratios where the confidence interval overlapped with 1, suggesting that it did not have a robust relationship with a reduction in stunting. There is some emerging evidence that LNS may also reduce illness and improve motor development, but there are two few studies to allow a strong conclusion on this (Tam, et al., 2020). There have been concerns that LNS-SQ may displace local complementary foods, cause excessive weight gain and affect taste preferences, but studies have not found evidence to support such concerns. The evidence is relatively new and therefore no WHO guidelines have yet been developed in this regard (Heidkamp, et al., 2021, Supplementary Materials: p. 3).

The 2013 and 2021 Lancet child and mother nutrition series included interventions with iron supplementation and multiple micronutrient interventions in its scope, but did not include these supplements in its list of recommended nutrional interventions. As explained at the start of this section, iron and multiple micronutrient supplementations are complementary and therefore often paired in systematic reviews. A review by Salam et al. (2013) found that MNPs reduced anaemia and iron-deficiency anaemia and increased haemoglobin concentrations. There was no significant and consistent impact on height for age or stunting and they report that MNPs increased the incidence of diarrhoea. The updated systematic review confirmed these results, reporting a consistent effect of micronutrient powders on reducing child anaemia, iron-deficiency anaemia and iron deficiency, but again with no consistently significant impact on height or stunting (Tam et al., 2020). This is summarised in Figure 1b below. In contrast to Figure 1a on stunting, where only LNS had an effect, we find that several approaches had an effect on iron deficiency. Given the multiple pathways that can result in stunting, it should be unsurprising that we find that a “package intervention” has a more robust and significant impact than products that focus on a single nutrient (zinc or iron supplementation) or a combination of basic micronutrients (micronutrient powder). SQ-LNS provides the basic micronutrients but also omega-3, protein and energy.

They also note that the diarrhoea side-effect has prompted initiatives to reduce the iron content of MNPs. In areas with a high prevalence of malaria, there are also concerns about iron supplementation increasing the risk of malaria-related morbidity and mortality. Tam et al. (2020) conclude that the evidence for recommending the use of MNPs is moderately strong.

Figure 1a: Meta-analyses for efficacy of nutritional supplements vs control on relative risk of stunting among children under five in LMICs

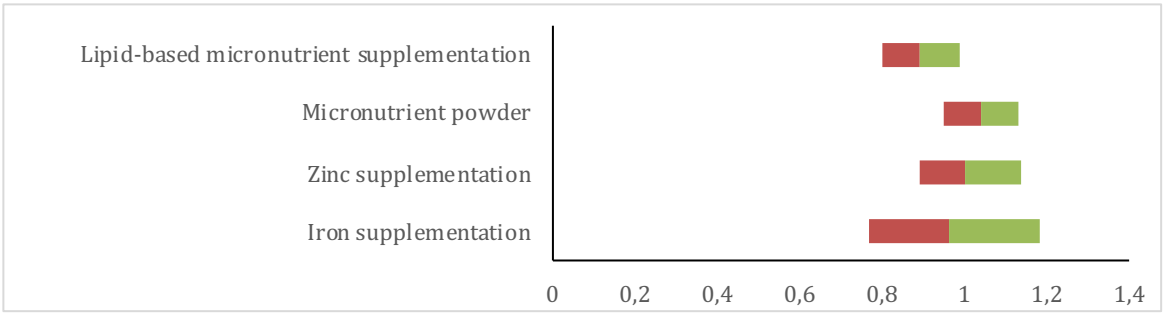
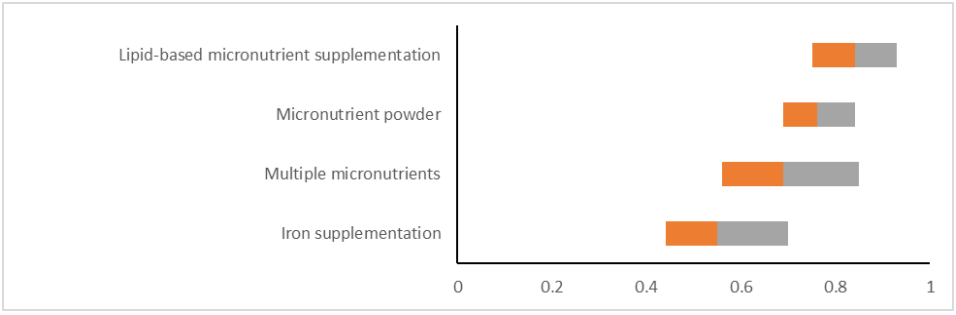


Figure 1b: ***Meta-analyses for efficacy of nutritional supplements vs control on relative risk of stunting among children under five in LMICs***



Source: Tam et al. (2020). These estimates are for efficacy, which means that they compare the control group to those who adhered to the treatment protocol , i.e. those who took the supplements. This would be in contrast to effectiveness study where all those who were allocated to the treatment group would be included in the control/comparison group. The meeting point between the orange/red and grey/green is the median and the orange/red and grey/green bars represents the lower and upper confidence intervals. Note that relative risk (RR) compares the probability of the outcome occurring for the treatment vs. the control group, thus the interpretation is with respect to 1, which would indicate no difference in the relative risk. The greater the distance from one, the larger the effect.

Micronutrient supplementation has been found to boost cognitive development. A meta-analysis of 67 interventions in 20 developing countries by Ip et al. (2017) showed that iron, zinc, calcium, vitamin B2, and protein supplementation improved the cognitive development of children below the age of eight. However, Tam et al. (2020) conclude that the impact of MNP on cognitive development was assessed by too few high-quality causal studies and therefore the evidence base for examining this relationship remains weak.

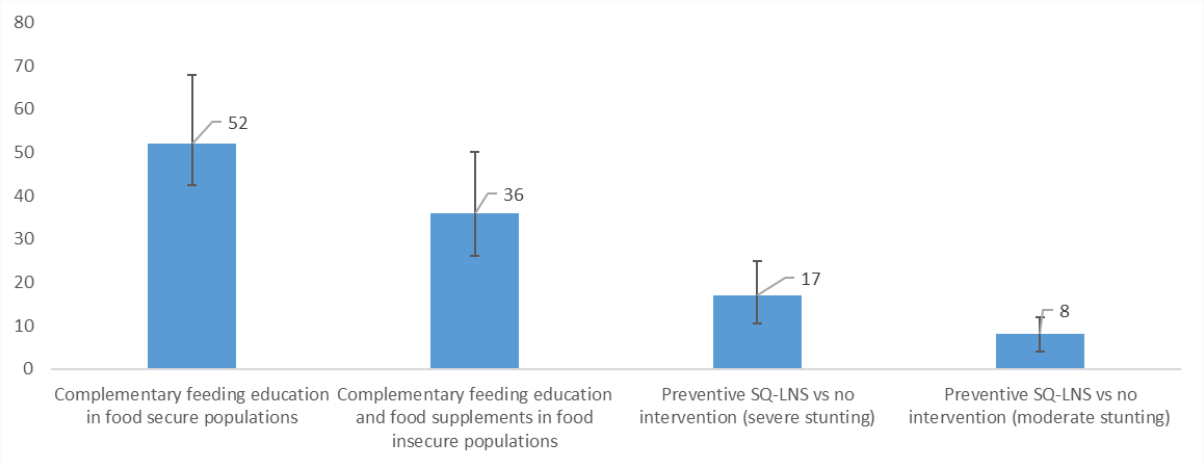
2.2. Complementary feeding promotion and education

Complementary feeding promotion and education interventions often take place in environments where healthy foods are available and affordable. Where this is not the case, researchers usually provide food supplements, such as food baskets or fortified supplements, in combination with the intervention.

The Lancet 2013 series on maternal and child undernutrition reviewed randomised and quasi-randomised trials to assess the impact of nutritional education (Lassi et al., 2013). Based on the evidence presented, they recommended complementary feeding education paired with supplementation. They found that nutrition education in food secure populations increased height, height-for-age (HAZ) scores and weight, while in food insecure populations it increased HAZ and weight-for-age (WAZ) scores and decreased the likelihood of stunting. Stunting and WAZ scores were not significantly affected by nutrition education in food secure populations. Complementary food provision, with or without education, in food insecure populations improved HAZ and WAZ scores but did not affect stunting. The 2021 updated systematic reviews largely confirmed earlier findings and supported the continued recommendation of complementary feeding education and supplementation. The 2021 review also

had an expanded scope. The reviews found that nutritional education interventions in food secure settings improved HAZ and WAZ scores, and also weight-for-height scores, and food supplements in food insecure environments improved HAZ scores and reduced stunting (Keats et al., 2021). Meta-analyses showed that well-designed education programmes have a positive impact on meal frequency and diet diversity, as well as child growth (Abdurahman et al., 2019; Imdad, Yakoob & Bhutta, 2011). Figure 2 below summarises the evidence presented by Keats et al. (2021) on the effect of complementary feeding programmes in food insecure and food secure environments on stunting risk.

Figure 2: ***Percentage reduction in stunting by nutrition interventions***



Source: Table 2 in Keats et al.(2021). The preventative SQ-LNS estimates are from Das, et al. (2019). The two impact estimates for complementary feeding education are from Lassi, et al. (2020).

Nutrition education has the largest effect in food secure environments, but it is encouraging to find that studies suggest that such education campaigns can also have an impact in food insecure settings when they specifically promote affordable and generally accessible nutrient-rich foods, particularly animal source foods such as eggs (Iannotti, Lutter & Stewart, 2017; Kim et al., 2019; Stewart, Caswell et al., 2019; Warren et al., 2020). Nutrition education campaigns aimed at promoting the consumption of eggs have been conducted in a variety of settings, including Bangladesh, Cotopaxi Province in Ecuador, rural Malawi and Ethiopia. Some studies only measured the increase in egg consumption and dietary diversity, but the Ecuador study (Iannotti et al., 2017) showed a significant decrease in stunting in children aged six to nine months.

In Colombia, Attanasio et al. (2018) supplied pregnant women, nursing mothers and children under two years of age with a nutritional supplement delivering 35% of their daily calorie consumption needs for 30 days. The supplement lowered the number of children whose height-for-age was below one standard deviation and raised the overall development measure (Bayley-III factor)[20]. Most notably, the findings revealed that the impacts on the Bayley-III factor were higher for children from impoverished families, highlighting the importance of targeting the interventions effectively.

Similar findings were reported in a review of evidence from 15 original educational intervention studies, including two studies from Africa (Shi & Zhang, 2011). The analysis showed that sharing information on complementary feeding effectively with mothers improved complementary feeding practices as well as child nutrition and growth. Another systematic review covering randomised controlled trials, quasi-randomised trials, and controlled before-after studies published over twenty years from 1997 to 2018 showed that using both home visit and group platforms was not only beneficial for early and exclusive breastfeeding but also reduced under-five wasting (Janmohamed et al., 2020). Reviewing the effect of 137 behavioural interventions on diet outcomes in children under the age of 18, Chambers, Segal and Sassi (2021) found that 74% of the interventions were effective in modifying these outcomes.

20 This refers to the third edition of the Bayley Scales of Infant and Toddler Development. It assesses five key developmental domains in children aged 1-42 months: language, cognition, motor skills, social-emotional and adaptive behavior.

Table 1: Summary of Keats et al. (2021) systematic reviews for nutrition interventions for complementary feeding age group

Research question	Population	Evidence reviewed	Location (number of studies done in each country)	Outcomes	Current estimates	Evidence of effect
Complementary feeding education alone vs. standard of care	Children aged 6-24 months	Systematic review of 12 studies	Brazil (2), Pakistan (2), Peru, China (2), Bangladesh, India (4)	HAZ; WAZ; stunting	Food secure populations: MD 0·25 increase (95% CI 0·04–0·45); MD 0·41 increase (0·07–0·75); 52% reduction (95% CI 20–71)	Moderate evidence
Complementary feeding provision with or without education vs standard of care	Children aged 6-24 months	Systematic review of 17 studies	Burkina Faso, Zambia, India, Nigeria, Vietnam, Ghana (2), Ecuador (2), DR Congo, Bangladesh, Malawi (2), Guatemala, Colombia, Brazil, China	HAZ; stunting; WAZ	Feeding & education in food insecure populations: MD 0·14 increase (95% CI 0·04–0·24); 36% reduction (8–56); MD 0·34 increase (95% CI 0·35 reduction to 1·03 increase)	Strong evidence
Preventive vitamin A supplementation vs placebo or no intervention	Children aged 1–59 months	Systematic review of 16 studies	India (3), Mexico (2),Ghana (2),Indonesia (2), Nepal,Papua New Guinea,Ecuador, Bangladesh,Guinea-Bissau,The Gambia, China,Kenya, Peru	All-cause mortality; diarrhoea incidence	10% reduction (95% CI 2% excess to 20% reduction); 3% reduction (95% CI 14% excess to 17% reduction)	Strong evidence
Preventive zinc supplementation vs placebo or no intervention	Children aged 1–59 months	Systematic review of 31 RCTs	Indonesia (5),Bangladesh (5),India (4),Burkina Faso (3),Tanzania (2),Mexico (2),Guatemala (2), Thailand, Ethiopia, Nepal, Brazil, Uganda, Vietnam, Laos;India (2),South Africa (2), Bangladesh, Peru	Diarrhoea incidence; lower respiratory tract infection; mean height	11% reduction (95% CI 3–18); 22% reduction (95% CI 17% excess to 47% reduction); MD 0·04 cm increase (95% CI 0·12 reduction to 0·20 increase)†	Moderate evidence
Micronutrient powders vs placebo or no intervention	Children aged 1–59 months	Systematic review of34 RCTs	India (4), Kenya (3), China (3), Bangladesh (2), Brazil (2), Ghana (2), Cambodia (2), Laos (2), Pakistan, Honduras, Mali, Ethiopia, Guatemala, North Korea, Nepal, Haiti, South Africa, Kyrgyzstan, Colombia, Nicaragua, Africa	Anaemia; iron-deficiency anaemia; iron-deficiency; diarrhoea	24% reduction (95% CI 16–31); 55% reduction (42–68); 50% reduction (37–60); 30% excess (11–53)	Moderate evidence
Preventive LNS-SQ vs no intervention	Children aged 6–23 months	Systematic review of 17 studies	Malawi (4),Bangladesh (3),Ghana (2),Burkina Faso, Chad, Congo, Guatemala, Haiti, Honduras, Kenya, Peru	Severe stunting; moderate stunting; moderate wasting; moderate underweight	17% reduction (95% CI 1–30); 8% reduction (0–16); 17% reduction (5–27); 12% reduction (4–20)	Strong evidence

Source: Keats et al. (2021)

A cluster-randomised trial conducted in rural Ethiopia from February 2017 to March 2018 evaluated the effect of a 9-month nutrition behaviour change communication intervention (Ayalew & Belachew, 2021). Mothers of infants younger than six months were eligible for enrolment. The intervention led to an increase in weight and length gain and significantly reduced the rates of infant stunting and underweight.

An intervention in rural Bangladesh targeted children aged 6 to 24 months with moderate malnutrition based on their weight-for-age (Roy et al., 2005). They were randomised into three groups: the first receiving intensive nutrition education twice a week for three months; the second receiving the same education, plus supplementary feeding for children; and the third, the control group, receiving the standard routine nutrition education from the community nutrition promoters twice a month. At the end of six months of observation 59% and 86% of the children in the first and second treatment groups had mild or no malnutrition (cf. moderate malnutrition), while only 30% of the children in the control group had mild or no malnutrition.

To aid implementation, *mHealth* nutrition tools can help decentralised frontline staff provide nutrition education to caregivers and parents and also serve as a vehicle for delivering nutrition messages directly to them. Evaluations of these tools confirmed their acceptability and also found that they promote engagement and contact with targeted beneficiaries (Heidkamp et al., 2021).

2.3. Income support

In a systematic review and meta-analysis of studies examining the impact of cash transfers on nutritional outcomes, Manley et al. (2020) found that cash transfers had a significant impact on HAZ scores and stunting but not on WAZ scores or wasting. The impact on height-for-age and stunting was most likely because of consumption of animal-source foods, improved dietary diversity and lower diarrhoea incidence. They also found that cash transfer programmes had a greater impact on linear growth and stunting when they were targeted at households with young children. A review by Heidkamp et al. (2021) of cash and food transfer programmes in Mexico, Bangladesh, and Pakistan yielded the same conclusions.

In assessments of cash transfer programmes cited above, researchers have combined both conditional and unconditional transfer arrangements, and it is therefore difficult to know to what extent the observed impact is attributable to increased motivation or to the additional income itself. The meta-analyses showed that conditionality did significantly increase the impact of cash transfer programmes on nutritional outcomes (Manley et al., 2020). A review of unconditional cash transfers by Pega et al. (2017) showed that there was only moderate-quality evidence of a reduction in child morbidity, and low-quality evidence of an increase in diet diversity. The study found the evidence base for reduction of stunting was weak and thus the authors concluded that the effects of unconditional cash transfers on stunting remained uncertain.

There is therefore no strong support for an effect of income by itself on stunting. There is little evidence to support the view that income support is a magic bullet. Despite the widespread belief that stunting is a poverty problem, little association has been found in LMICs between income per capita and stunting (Vollmer et al., 2014). The literature suggests that it would require more than cash transfers to change stunting levels convincingly. Heidkamp et al. (2021) found that the effectiveness of cash transfers was reliant on their magnitude, and that the transfers needed to be large enough to contribute meaningfully to the household's current income. It is therefore a matter for concern that such transfers are often prohibitively costly for the poor countries where they are needed most. In addition, it has been shown that cash transfers are more effective when combined with other strategies such as micronutrient supplementation, empowerment of women and behaviour change interventions (i.e. conditional grants), again suggesting that cash transfers on their own would not be sufficient to make a substantial difference to levels of stunting. Social grants are one tool policymakers use to make more money available in the home for food. However, the additional income will not

necessarily be spent on food, and even if it is, it will not necessarily reduce stunting unless it is spent on food for the child, and the right kind of food. In short, grants are an expensive intervention and do not necessarily reduce stunting.

2.4. Food environment and food security

In an overview of impact evaluation studies and observational data, Ruel, et al, (2018) found that nutrition-sensitive agricultural programmes increased household production, diet diversity and micronutrient intake and decreased nutritional deficiencies. They also found that the programmes were more effective when they included communications on changing nutrition and health behaviour and sought to empower women. Programmes had a larger impact on the nutritional status of children when they included health and WASH interventions and micronutrient-fortified products.

There is evidence that biofortification[21] may increase micronutrient status and reduce diarrhoea (Jones & De Brauw, 2015; Low, 2013). A systematic review and meta-analysis by Keats et al. (2019) of the real-world impact of large-scale fortification of popular and affordable foods with key micronutrients (vitamin A, iodine, iron and folic acid) showed that fortification significantly reduces the likelihood of anaemia, goitre and neural tube defects in LMICs. It is also cost-effective, estimated to provide 27 dollars in benefits for every dollar spent (Garrett et al., 2019). However, women older than 18 appear to benefit more from such fortification than young children, an effect which is attributed to adults' ability to consume larger quantities of the fortified staple foods (Keats et al., 2019).

2.5. WASH (water, sanitation and hygiene)

Earlier in this report we mentioned that EED is associated with the widespread poor sanitation, gut infection and micronutrient deficiencies in many communities in LMICs, and also explained that the the syndrome is not easily eliminated as it needs to be addressed at a community level. EED may also explain the lack of impact of WASH interventions because of randomised individual selection of households for treatment (Tickell et al., 2019).

Recent experimental evidence on three large WASH interventions has been disappointing, providing no support for a strong role for these interventions in promoting child growth and reducing diarrhoea (Humphrey et al., 2019; Luby et al., 2018; Null et al., 2018). Following the disappointing results of the interventions, an expert meeting was convened by the WHO and the Bill and Melinda Gates Foundation. Those who attended this meeting published a consensus statement to say that while these three trials did not have an impact, they do not believe that this should be interpreted as general evidence that WASH interventions do not work. Instead, it may rather indicate that more ambitious and comprehensive WASH interventions are required. Additionally, they concluded that WASH interventions need to be customised to take into account the social context and the specific environmental health pathways as well as the enteric disease burden[22] (Cumming et al., 2019).

3. Contextual considerations for nutrition interventions in South Africa over the next five years

Despite a number of important policies to improve nutrition (see Appendices A2 and A3), stunting in South Africa remains at high levels. Iversen, Marais, du Plessis, et al. (2012) found that South Africa's Integrated Nutrition Programme failed to restore growth rates among malnourished children and

21 Biofortification uses biotechnology and plant breeding to boost the micronutrient content of staple crops.

22 Enteric diseases are intestinal illnesses caused by viruses, bacteria and parasites. Such diseases frequently spread via contaminated food or water, but can also be transmitted between people.

attributed this failure to weak programme implementation and poor scalability. This is a recurring theme in the literature reviewing South African nutrition policies, and the problem may be partly that the policies are ambitious and not well-matched to the budget and resources available. However, the aim of this working paper is not to critique policy, but to consider the prioritisation given to scarce resources and the limited implementation capacity.

Our review of the international literature on nutrition interventions shows that there is enough evidence to know what works in nutrition. The evidence suggests that two main nutritional interventions for the complementary feeding age group can be considered as a way forward for South Africa's stunting crisis: education on appropriate complementary feeding practices (including recommending affordable and accessible nutrient-rich foods that are appropriate for this age group) for community and caregivers, and the prescription and promotion of small-quantity lipid-based nutritional supplements (LNS-SQ).

We compiled a list of recommended foods for the complementary feeding age by identifying affordable and locally accessible foods suitable for combating nutrient deficiencies in South Africa's complementary feeding age children (Ryckman et al., 2021) and referring to the revised South African Paediatric Food-Based Dietary Guidelines (Du Plessis et al., 2021). Accordingly, we recommend that caregivers feed children of this age the following foods:

- chicken liver, small tinned fish such as sardines, eggs, chicken, or peanut butter
- milk, maas, or plain unsweetened yoghurt
- dark green leafy vegetables such as spinach or indigenous green leaves
- yellow, orange and deep red vegetables and fruit, such as carrot, tomato, pumpkin, orange-flesh sweet potato, apricot, or mango

While the promotion of LNS-SQ is supported by strong evidence, it is a relatively new product and has thus not yet been included in WHO guidelines. However, South African studies have shown that LNS is acceptable and that it has an impact on child growth outcomes (Rothman, et al., 2015; Smuts, et al., 2019). LNS-SQ has been designed to prevent malnutrition and stunting and its application therefore calls for the targeting of a subpopulation of children considered to be at high risk of stunting. As a quick exercise, we used data from the 2016 Demographic and Health Survey to consider feasible targeting strategies that effectively identify a high-risk group and would be easy to implement in practice because the criteria are observable and verifiable. Targeting households that lack electric or gas stoves or a refrigerator, we can for instance reach 44% of stunted children. For this targeted subgroup, the stunting rate for children under five is 38%, compared with 27% for the full sample, which is higher than the stunting rate of 36% for the poorest quintile. It is important to note that this targeting strategy covers 81% of the poorest quintile households. However, this example of a feasible targeting approach is illustrative and not intended as a recommendation but as a starting point for a broader and more in-depth public conversation about how to best target stunting prevention interventions.

Since this working paper prioritises *evidence* on stunting, we focus on nutrition interventions that are amenable to impact assessment. However, we acknowledge the important contribution of macro-level policy shifts such as post-pandemic social security reform, health care reform, improved service delivery (with a focus on WASH) and the necessary regulation to curtail advertisements that promote unhealthy foods for this age group and programmes and policies that promote access to nutritious food and optimise the nutrient content of food.

The 2021 Lancet series on maternal and child undernutrition progress concludes that despite ample evidence on what interventions worked for combating undernutrition and stunting in LMICs, governments have failed to implement these interventions well at scale. They maintain that "the pressing issue remains how to deliver at scale what we know works—a question that demands more investment in implementation research" (Heidkamp et al., 2021). Effective and consistent

implementation is vital to ensure that interventions deliver population-level improvements in outcomes, especially in the poorest communities. In this section we therefore consider the viability of the two interventions we recommend – complementary feeding education, including the promotion of foods that are rich sources of specific nutrients that are crucial for this age group, and the use of LNS-SQ – within the South African social context and against the backdrop of current local implementation capacity and fiscal constraints.

3.1. Fiscal constraints

We consider the feasibility and context-appropriateness of these two evidence-based nutrition interventions for South Africa at a time when the country is facing severe fiscal constraints. With high government debt, slow growth and the economy still recovering from the disruptions of the COVID-19 pandemic, there have been widespread calls to contain spending and to use the available resources more effectively.

Costing and cost-effectiveness estimations help to make resource decisions and trade-offs more explicit. If their shortcomings, weaknesses and limitations are kept in mind, these methods can help decision makers to enhance transparency and accountability and promote effective resource allocation.

Two recent studies (Galasso & Wagstaff, 2019; Desmond et al., 2021) have considered whether the package of ten nutritional interventions recommended by Bhutta et al. (2013) [23] would be cost-effective for South Africa to implement. Unfortunately, but understandably, there have not yet been costing estimates for the 2021 package of recommended interventions. However, a recent study in Niger estimated the cost of a "first 1000 days" package of interventions and mention that their estimated incremental cost for supplying one child aged 6 to 23 months with LNS-SQ for a year was 30 US dollars (Hiebert et al., 2021).

Galasso and Wagstaff (2019) estimated the expected economic value and the costs associated with scaling up the Bhutta et al. (2013) package of interventions over a period of 10 years in the 34 countries which collectively account for 90% of global stunting. They found that the estimated rate of return to the investment in the package was 12% and the cost-benefit ratio ranged from 1:5 to 1:6.

They also estimated what share of a country's current per capita income was lost due to the childhood stunting of its workforce, focusing on the 34 countries that together represent 90% of the world's stunting burden. As mentioned before, this includes South Africa. They found that, without childhood stunting of the workforce, the per capita income of the countries would have been between 5 and 7% higher. For Asian and African countries, their estimate of lost per capita income due to childhood stunting was higher, with an average of 9%.

Both of their estimations used a development accounting framework which relies on micro-econometric estimates of the effects of childhood stunting on adult wages. The model assumes that differences in income per worker are because of differences in observables like physical and human capital (cognition, health and education). The logic is that if workers were not stunted, they would have better cognitive development and better education performance and thus better employment opportunities and higher incomes. The model also assumes that skilled and unskilled workers are perfect substitutes. It is also a partial comparative statistics analysis, focusing on how childhood stunting translates into adult earnings via human capital, assuming that other correlates such as total factor productivity and aggregate physical capital are held constant. The model accounts only for private returns to investing in human capital, disregarding positive externalities from human capital development. For example, more educated and skilled workers are likely to be more innovative and adopt technology faster, which will improve factor productivity. And more importantly, the model ignores intergenerational benefits of human capital passing from parents to children.

23 The evidence-based nutrition interventions recommended by Bhutta et al. (2013) include folic acid supplementation or fortification for all women of reproductive age, calcium supplementation in pregnancy, multiple micronutrient supplementation in pregnancy, balanced energy supplementation, breastfeeding promotion, supplementary feeding and education for the complementary feeding age, vitamin A supplementation for children 6 to 23 months, zinc supplementation for children 6 to 59 months, therapeutic feeding for severe wasting, and treatment for moderately acute malnutrition.

Desmond et al. (2021) also estimated the cost-benefit of scaling up the Bhutta et al. (2013) package of nutrition interventions to 90% coverage.[24] This study's strength is that it takes into account contextual constraints specific to South Africa: baseline coverage of interventions, nutritional status, health outcomes, poverty rates, living and playing conditions, school quality, and labour market opportunities. The nutrition interventions are assumed to deliver social and economic benefits by reducing malnutrition and mortality and thus increasing years of schooling and future earnings. The authors considered how effects may vary across socioeconomic groups. They estimated the cost and impact of scaling up the package to 90% for a 2021 cohort of South African children. To capture the role of context, they estimated benefits with and without additional improvements in school quality and employment opportunities by socioeconomic quintile. They found that scaling up the package reduced national stunting rates among two year olds by 3.18 percentage points. This implies an increase in mean HAZ of 0.10. As expected, the poorest (quintile 1) had the largest decrease in stunting and largest increase in mean HAZ. The cost of scaling up interventions was higher in quintiles 1 and 2 due to lower baseline coverage rates and the higher need for targeted interventions. The estimated cost of scaling up was US$90 million (R1.4bn).

In terms of the cost-benefit ratios, the highest return they found was for the richest. However, if contextual factors like school quality and labour force participation were equal, the highest return would be for the poorest quintile. Thus, reducing inequality in baseline contextual factors narrows the gap between the richest and poorest.

They found that, overall, US$1 investment in interventions returned US$18 in productivity in South Africa. This return is towards the upper end in the literature for sub-Saharan Africa, where the World Bank reported a benefit-cost ratio of 1:9 for 21 sub-Saharan African countries. It is, however, lower than in other LMICs such as the countries of the Middle East and North Africa, East Asia and Pacific , and South Asia.

Their main point is that without supporting interventions to lift other constraints, investments in early nutrition for the vulnerable groups are unlikely to yield the expected returns in terms of human development. Such constraints are expected to be more of an impediment in poorer societies or countries, which highlights the importance of combining nutrition interventions with supporting interventions outside the health sector. For South Africa, they identified the most serious constraints on human development as poor quality of education, high youth unemployment and inequality. This is also a social justice issue, because in South Africa school quality and labour force participation are not equal across the income distribution.

Although the two sets of cost-benefit estimates reported here (Galasso & Wagstaff, 2019; Desmond et al., 2021) rely on contestable assumptions, their estimates do substantially strengthen the case in support of investing in the package of ten nutritional interventions recommended by Bhutta et al. (2013). However, over the medium term, affordability and financing can still be an issue because of liquidity constraints. External funding for local experiments could help to tighten the investment case for prioritising these nutrition investments. In addition, local evidence on how different risk groups respond to these interventions could inform detailed research recommendations on how best to combine these two strategies.

3.2. Contextual constraints (social, caregiving and food availability)

Even before the pandemic, poverty levels were high in South Africa, with about half of adults and 40% of all South Africans living below the upper-bound poverty line of R1335 per person per month (Stats SA, 2019a). Based on the subsequent large-scale job loss during the pandemic these shares are expected to have increased significantly. Housing choices are limited for low-income households and environmental health problems such as inadequate sanitation, lack of refuse collection, air pollution and poor access to clean water are widespread in their neighbourhoods.

24 The recommended supplements would include zinc. We do not include vitamin A supplementation in our recommendation because this is already an implemented policy, with 72% coverage for children aged 6 to 59 months as reported in the 2016 SADHS (NDoH, Stats SA, SAMRC, & ICF, 2019).

The diets of South African children remain a cause for concern. The top five foods eaten by South African children aged 1 to 9 years before 2005 were maize meal, sugar, tea, whole milk and brown bread (Labadarios et al., 2005). Dietary diversity was low, with inadequate consumption of fruit and vegetables (Labadarios, Steyn & Nel, 2011). Statistics from the 2016 SADHS (South African Demographic and Health Survey) show that less than a quarter of the children of complementary feeding age were fed a minimum acceptable diet.[25] Less than half of the children of complementary feeding age met the criteria for minimum dietary diversity and just over half met the criteria for minimum meal frequency.[26] A large share of children consumed sugary drinks (18%), sugary foods (35%) and salty snacks (44%). Fifty-eight percent of breastfed children under two years and 77.9% of non-breastfed children consumed food made from grains. Food made from legumes and nuts was the least consumed, with only 6% of breastfed children and 14% of non-breastfed children consuming such food (NDoH, Stats SA, SAMRC, & ICF, 2019). Maize porridge and commercial infant cereal are frequently a first food for infants and complementary feeding tends to include few animal source foods (Sayed & Schönfeldt, 2020). Low dietary diversity is associated with several markers of poverty such as the lack of access to electricity, sanitation or clean water, employment as a casual worker, living in a traditional house, being sick or disabled, and buying from a local spaza store in the vicinity (Labadarios et al., 2011).

These household food choices do not happen in a vacuum but are determined by the surrounding food environment. It was a matter of concern that Cape Town research found that lower-income areas have the lowest ratio of supermarkets to the square kilometre (Peyton, Moseley & Battersby, 2015) and that supermarkets in lower-income areas are less likely to stock healthy foods (Battersby & Peyton, 2014). However, in low-income areas there is also a high prevalence of informal retail businesses selling small quantities of food at low prices and offering informal credit.

For the complementary age group, one of the most serious constraints the country faces for improving nutrition may be its parental deficit. This is partly an inheritance from the apartheid era, but the high HIV mortality of the past two decades among the prime aged population has also had a devastating impact. Parental deficit is much more widespread in South Africa than in most other African countries.[27] Due to the HIV crisis In South Africa 20% of children live with neither of their parents (Stats SA, 2019b). It has been shown that the stunting burden is substantially higher in this vulnerable subgroup (Bridgman & Von Fintel, 2022). South Africa also has a higher than average share (46%) of children living with only one biological parent (Stats SA, 2019b). In these cases it is generally the mother, with 43% living only with the mother and not the father and 3% living only with the father and not the mother.

The spatial and logistical structure of South Africa's towns and cities further contributes to this problem: lower-income households can often only find housing on the outskirts of the towns or cities, far away from most jobs. Due to a lack of public transport infrastructure, mini-bus taxis are the dominant mode of transport for those without cars. This means that working parents spend a large part of their week travelling to and from work, further reducing the share of their day available to their children. Many low-skilled jobs have long hours and little flexibility, and are not easily combined with the responsibilities of a single parent. We must therefore consider caregiving and feeding responsibilities more broadly, not narrowly focusing on the biological mother.

In South Africa, one out of every five children under two attends an early childhood development (ECD) group or centre for at least one day of the week (Ilifa Labantwana, 2019). Figure 3 shows that the most common childcare arrangement for children is staying home with their caregiver (parent, foster parent or guardian), particularly when less than a year old. About 73% of children aged 0 to 11 months

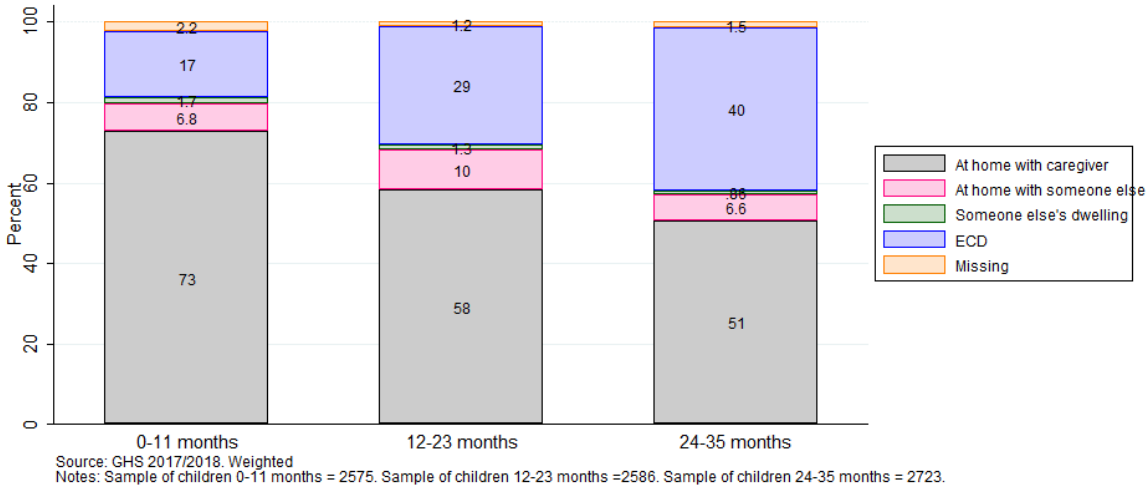
25 Children are said to have a minimum acceptable diet if they meet the criteria for minimum dietary diversity, minimum meal frequency, and appropriate milk feeds.

26 *Minimum dietary diversity* means foods from at least four of the following food groups: grains, roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables. *Minimum meal frequency* means solid, semisolid or soft foods at least twice a day for breastfed children aged 6 to 8 months, at least three times a day for breastfed children aged 9 to 23 months, and at least four times a day for non-breastfed children aged 6 to 23 months (NDoH, Stats SA, SAMRC, & ICF, 2019).

27 Zuberi and Zulu (1996) report the share of children living with both biological parents for six African countries. For five of them, approximately 6 to 7 out of 10 children were living with both biological parents. For Namibia it was 4 out of 10, which is below but close to current estimates for South Africa. Dlamini (2006) reports similar ranges for a different set of 10 countries, but with similar findings: in general 6 out of 10 children were living with both parents, but for the three southern African countries the proportion was much lower at 3 to 4 out of 10.

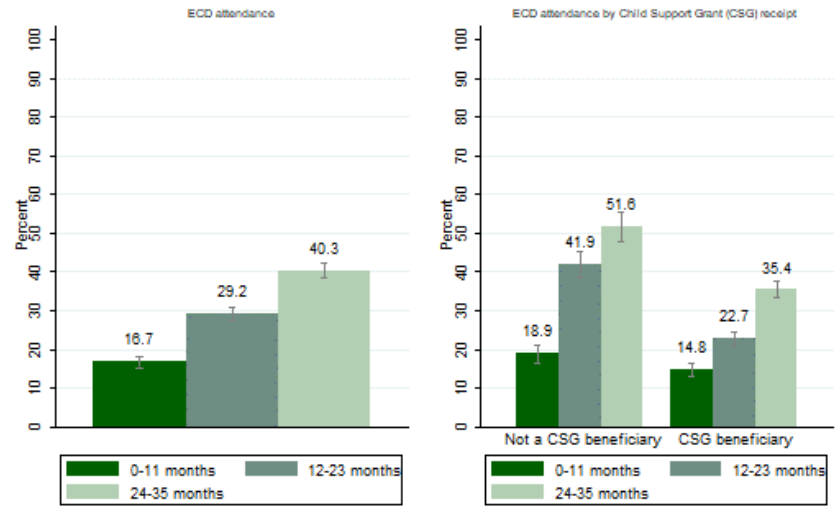
are cared for during the day at home by their caregiver, but this declines to 58% for children 12 to 23 months. However, while home care is the most common mode of care for infants, care outside the home is quite widespread. In 2017/18, 23% of children aged 0 to 23 months were attending some form of early childhood care or educational (ECCE) institution, according to the General Household Survey (GHS) (Stats SA, 2019bx).[28] Approximately 17% of children aged 0 to 11 months, 29% of children aged 12 to 23 months and 40% of children aged 24 to 35 months were attending ECCE (see Figure 4). The most common form of ECCE arrangements for children under 12 months is being cared for by a 'day-mother', 'gogo' or childminder, followed by attending a crèche or educare centre (see Figure 5). For children aged 12 to 35 months, attending a crèche or educare centre is the typical mode of ECCE used outside the home.

Figure 3: Childcare arrangements during the day, children aged 0–35 months



Note: A very broad definition is used to measure ECCE access here for young groups. If respondents said yes to any of the following the child is considered to be attending ECCE: Grade R, pre-school or nursery school or Grade 00 or Grade 000, crèche or educare centre, or day-mother or 'gogo' or childminder, home or community playgroup, other (specify), school.

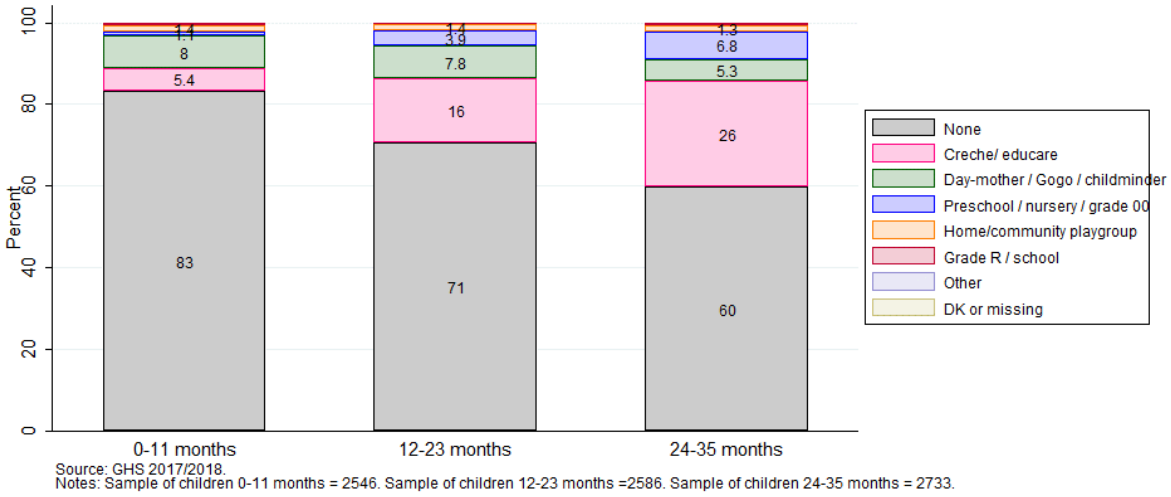
Figure 4: ECCE attendance of children aged 0–35 months, by Child Support Grant receipt



Note: A very broad definition is used to measure ECCE access here for young groups. If respondents said yes to any of the following the child is considered to be attending ECCE: Grade R, pre-school or nursery school or Grade 00 or Grade 000, crèche or educare centre, or day-mother or 'gogo' or childminder, home or community playgroup, other (specify), school.

28 Own calculations from the GHS.

Figure 5: Type of ECCE facility attended by children aged 0–35 months



Source: GHS 2017/2018.
Notes: Sample of children 0-11 months = 2546. Sample of children 12-23 months =2586. Sample of children 24-35 months = 2733.

Note: A very broad definition is used to measure ECCE access here for young groups. If respondents said yes to any of the following the child is considered to be attending ECCE: Grade R, pre-school or nursery school or Grade 00 or Grade 000, crèche or educare centre, or day-mother or 'gogo' or childminder, home or community playgroup, other (specify), school. DK means don't know.

It is vital to know whether ECCE coverage is worse for low-income groups. These are the very children whose nutritional status is likely to be most compromised due to their lower socio-economic status and who could benefit from effective nutritional programming at ECCE sites. If the caregiver is a Child Support Grant beneficiary this is likely to mean that the household will pass the income means test that makes the child eligible for state support for ECCE access. Figure 4 shows ECCE facility attendance per age group for children who were CSG recipients or non-recipients in 2018. At all ages, ECCE access is skewed towards high-income groups. Only one in five of the children aged 0 to 23 months who were receiving a CSG were attending some form of ECCE.

3.3. Implementation constraints

In this section we consider the implementation of the two recommended nutrition interventions (complementary feeding education, including the promotion of foods that are rich sources of specific nutrients that are crucial for this age group, and the use of LNS-SQ) by asking how they can feasibly and equitably be implemented at scale and with high community-level coverage, taking into account local implementation capacity and South Africa's past experience with implementing similar programmes. Nutrition interventions with national reach have traditionally been implemented by the public health care system and particularly, the network of public primary healthcare clinics. As reported above (see Figure 3), most of the children in the complementary feeding age group are being cared for at home (80% of those 0 to 11 months, and 68% of those 12 to 23 months). Therefore, in aiming to prevent stunting, nutritional interventions for children in this group should in the main be targeted at parents or caregivers. The most effective way to reach this age group may be via the network of clinics. However, patchy logistics, poor ICT infrastructure, a shortage of managerial skills, weak coordination and a shortage of trained nutritionists remain challenges for any national initiative delivered via this network.

A subset of the interventions reviewed have already been implemented by the health system. Since evidence shows that high-dose periodic vitamin A supplementation reduces child mortality, the government has provided Vitamin A supplementation since 2002. Results from the 2016 DHS found that 72% of children aged 6 to 59 months had taken a Vitamin A supplement over the past six months (NDoH, Stats SA, SAMRC, and ICF, 2019). Since 2003 the government has fortified maize meal and wheat flour with a range of micronutrients, including Vitamin A. These interventions have proven to be successful, at least in part.

It is worthwhile considering whether ECCE groups and centres could play a supporting role in the fight against stunting. There are three compelling arguments in favour of such a role for the sector. Firstly, it is clear that stunting is a multi-dimensional problem and therefore it would be appropriate to consider cross-departmental collaboration. Secondly, there is evidence from systematic reviews of community-based approaches, such as community health worker home visits and mother-to-mother peer groups, that shows that such approaches can help widen and deepen the reach of efforts to scale up nutrition interventions (Heidkamp et al., 2021). ECCE networks could plausibly fulfil a similar function: serving as a community base to encourage deeper community-based roots and more responsiveness to local needs, thereby complementing existing but more formal and often more top-down programmes implemented by the National Department of Health's network of public primary clinics. And thirdly, a partnership between ECCEs and public clinics in the fight against stunting could create synergistic coverage. Public clinics have close to universal coverage of children when they are young and receiving immunisations, but coverage declines thereafter. By contrast, as mentioned earlier, ECCE institutions' coverage is initially low but then rises with age, reaching almost 80% coverage when children are four and five years old.[29] ECCEs can make a direct contribution to improving nutrition and combating hunger and stunting via the food they provide to children under their care, and also via social and cognitive stimulation. However, for a large share of children who only start attending these institutions when they are older, this will be too late. ECCEs also have a potential additional role as a champion and a promoter of improved feeding and nutrition knowledge.

Such a broader role for ECCE centres and groups would be in line with what the National Development Plan envisaged for the sector (NDP 2011:300). The NDP emphasised the role of ECDs for promoting better nutrition for children and providing them with it. The Plan says that "universal access to quality early childhood development for children aged zero to three must be made available and have a strong nutrition and educational focus". It is important to note that the NDP defines ECD in terms of a broader multi-sectorial or comprehensive set of ECD services and does not necessarily refer to services provided through a registered ECCE site or centre. To meet the universal commitment to strong nutritional programming for children under three as stated in the NDP requires consideration of various channels by which infants and young children can be reached through improved nutrition.

With the responsibility for ECD centres and groups migrating from the Department of Social Development to the Department of Basic Education (2021/2022), the ECD sector may benefit from the arrangements and programmes that are already in place for schools, including more oversight and monitoring, the focus on training opportunities and training requirements, and the School Nutrition Programme. This move may also provide an opportunity for rethinking the role and aims of this sector. As a window on the sector, the 2021/22 ECD Census and Audit will make the shape and size of the sector visible, to support rethinking the role of government in steering, regulating and supporting ECD centres and groups.

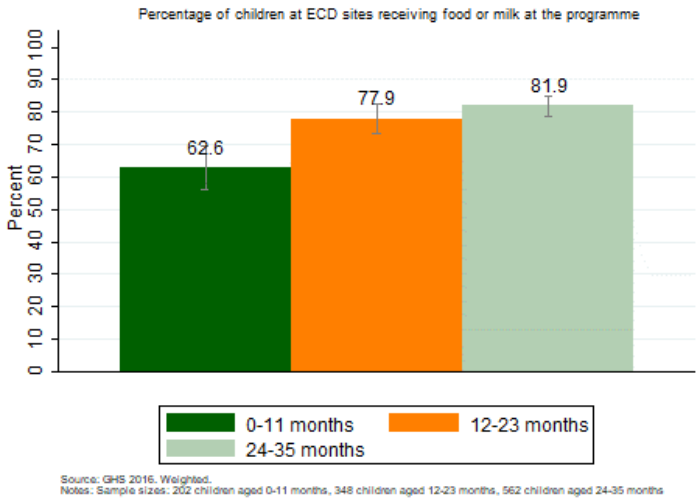
This transition may also provide an opportunity for reflecting on the role of government subsidies for ECD centres and groups, and in particular to reconsider the eligibility requirements for such subsidies. Currently government subsidies for ECDs can only be accessed where ECD centres have been registered as NPOs and partial care programmes. Registration requirements are onerous and costly to meet, which constrains access to ECD subsidies for the poorest children. Furthermore, financing allocations for subsidies are very limited, so that provincial departments have no incentive to increase the pool of registered programmes. Yet the nutritional component of the ECD subsidy (which is 50% of the current ECD subsidy amount of R17 per child per day) could, through improved education of parents and ECD staff, play a stronger role in improving the quantity and quality of food that children receive at these sites. For example, if the nutritional component of the subsidy was offered to ECD sites regardless of registration status, this would boost the available income to support nutritional programming. That said, we need to also consider that the budget is limited and as shown above, only a small share of children in the complementary feeding age group attend ECD centres.

29 This is from our own calculations using the GHS 2017/2018. We found that 79% of the four and five year old group were attending Grade R, pre-school or nursery school or Grade 00 or Grade 000, crèche or educare centre, or day-mother or 'gogo' or childminder, home or community playgroup, other or school.

Although the majority of children at ECD sites receive milk or food during the day, there are still too many who do not receive enough or sufficiently nutritious food. For example, in ECD programmes in 2016, only about 62% of children aged 0 to 11 months received food or milk, compared to 78% of those aged 12 to 23 months and 82% of those 24 to 35 months (see Figure 4). We note that children aged 0 to 11 months are more likely to receive food or milk at ECD programmes if they are no longer breastfed. Yet Wills (2021), using the 2013/14 ECD Audit data shows large variation in the quantity and quality of the food at those centres that provide it, reflected in how much was spent per child per day on food and the dietary diversity of the food served. Wills (2021) goes on to show that access to state ECD subsidies substantially increases the likelihood that ECD sites will provide food or milk to children, that more will be spent monthly on food per child attending and that the food provided will be of higher dietary diversity. Despite the importance of subsidies in improving not only the quality of nutritional programming at ECD sites but also the quality of stimulation provided, the reach of subsidies even to CSG beneficiaries remains very limited (Wills, 2021).

The NDP commitment to ensure universal access to quality ECD programming for children under three years is laudable (although we note that children under three are in the main cared for at home). But this goal should not take precedence over ensuring that ECD programmes and practitioners are equipped with the necessary knowledge of high-quality nutrition and the financial means to provide it. Allocating more state budgets to ECD subsidies could support improved nutritional programming for the youngest children. The nutritional component of the ECD subsidy could be decoupled from the stringent and costly norms and standards that must be met in order to register, so that ECD registration will not be an obstacle to extending the reach of the nutritional component of the subsidy.

Figure 6: Percentage of children aged 0–35 months at ECCE sites receiving food or milk



Note: We include among those programmes providing food, cases where parents provide the milk/food for the centre to give the child. A very broad definition is used to measure ECCE here for young groups. If respondents said yes to any of the following the child is considered to be attending ECCE: Grade R, pre-school or nursery school or Grade 00 or Grade 000, crèche or educare centre, or day-mother or 'gogo' or childminder, home or community playgroup, other (specify), school.

However, constraints should also be noted: despite its acknowledged important role in human capital formation, a large share of the ECCE sector's centres remain under-resourced and underfunded. Not all facilities have electricity and clean running water. Therefore, any short to medium term nutrition strategy targeting ECCE groups and centres cannot be reliant on electricity and easy access to clean running water if it wants to serve the most vulnerable communities. Over the long term it will be vital to expand ECCE institutions' access to running water and electricity, especially in the light of the findings with respect to WASH's impact on stunting. Lack of space, and particularly storage space, may also often be a constraint, thus any nutritional or food supplements would need to be space efficient. It is also important to bear in mind that there is currently no logistical system serving ECDs and this may be a challenge when using ECCE networks to distribute food or nutritional supplements. Over

the short to medium term, while many ECCE groups and centres remain without access to electricity, nutritional or food supplements with a long shelf life will need to be part of the package of solutions.

The countrywide, but more diffused and slower-acting supporting macro interventions, make them unsuitable for RCT studies and therefore this working paper devotes less attention to such policies and programmes. However, this does not mean that such policies are not important. It will be crucial to support nutrition interventions with aligned high-level policies such as social security reform, health care reform, and improved service delivery (with a focus on WASH), as well as regulations to curtail advertisements promoting unhealthy food choice and policies to promote the wider availability of healthy foods.

In addition, we urgently need better routine data on breastfeeding, vitamin deficiencies, wasting, underweight and stunting in order to assess whether the recommended nutrition strategies are working and having the envisaged widespread impact on child growth and development. Easier and more rapid access to routine data can help government and NPO partners to identify and remove implementation glitches at an earlier stage, facilitating a greater responsiveness to community needs and better alignment to the overarching vision of improving lives and reducing stunting. Such data can help boost implementation research on how to deliver evidence-based nutrition interventions at scale. This was identified as a major research gap in the 2021 Lancet series on maternal and child undernutrition (Heidkamp et al., 2021).

Such routine data can help improve our understanding of stunting, especially if coupled with a broader commitment to providing better child development data, including more regular nutrition surveys, and more routine checks of nutritional deficiencies and child growth. It is a matter for concern that so little research has been done on stunting, given the seriousness of the problem for child development, poverty alleviation and social justice (Casale et al., 2018). Better data could help researchers to fill this gap.

4. Conclusions

Given South Africa's stunting crisis, this working paper considers the implications of international evidence on interventions to combat stunting. We are sensitive to fiscal and implementation constraints because they limit the solutions that are expected to feasibly and effectively reduce stunting at scale. We recommend two interventions for the complementary feeding age group: complementary feeding education, including recommendations about affordable and available nutrient-rich foods crucial for this age group, and the prescription and promotion of LNS-SQ (small-quantity lipid-based nutrient supplementation).

We also highlight the importance of supporting policies, including regulation to curtail advertisements promoting unhealthy food choice, policies and social mobilisation campaigns to promote the wider availability of healthy foods, and better routine data collection on child nutrition and growth outcomes.

We note that ECCE groups and centres have an important role to play in supporting such policies – both directly through social and cognitive stimulation and better feeding, but also potentially indirectly, by serving as anti-stunting champions and community-based contact points for complementary feeding education and promotion of nutritional supplements.

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Appendix A1. Low rates of breastfeeding in South Africa

For infants aged 0 to 6 months, exclusive breastfeeding is recommended as the optimal form of nutrition, but in South Africa breastfeeding rates remain very low with only a small percentage of babies being breastfed exclusively (Du Plessis & Pereira, 2013). Though still low, an increase in exclusive breastfeeding rate for infants was recorded from 2010 to 2013, a period that coincides with major changes in the national breastfeeding policy (Jackson et al., 2019). Early postpartum breastfeeding is typical, but with early termination before the end of the recommended six month period. According to the WHO, 44% of infants are breastfed shortly after birth, and 40% of children younger than six months old are breastfed exclusively (WHO, 2016; 2018). Compared to other African countries, South Africa has one of the lowest breastfeeding rates (Vitalis, Witten and Pérez-Escamilla, 2022). Mixed feeding rather than exclusive breastfeeding is the norm in South Africa.

Women in South Africa are entitled to up to four months of maternity leave, however, with the exception of government service and some large corporations, this is primarily unpaid leave, leaving babies of women working in other sectors subject to substandard feeding and care practices (Du Plessis et al., 2016; Du Plessis & Pereira, 2013). The quality of prenatal breastfeeding assistance is variable to poor, and that mothers do not receive enough help in their homes, communities or workplaces once they leave the hospital (Du Plessis et al., 2016; Du Plessis & Pereira, 2013). In the same vein, a systematic literature review on feeding practices in South Africa by Vitalis et al. (2021) found that school and work commitments were some of the reasons why mothers discontinue exclusive breast feeding.

Vitalis et al. (2021) argue that in South Africa the infant formula industry's free distribution of infant formula to HIV-positive women– a marketing technique that violates the WHO Code -- has contributed to suboptimal breastfeeding practices among both HIV-positive and HIV-negative women. Du Plessis et al. (2016) note that the South African government rarely uses the media to communicate nutrition policy messaging, which is problematic given the food industry's aggressive marketing of non-nutritious foods.

Du Plessis et al. (2016) attribute early termination of breastfeeding to insufficient and poor counselling by health experts, as well as a lack of understanding among health workers about the value of exclusive breastfeeding. Aligned with this, Doherty et al. (2006) found that lack of support from health staff, in addition to lack of family support, deterred HIV-positive women from exclusive breastfeeding. Further, healthcare providers' use of formula, in the earlier days of the HIV pandemic, to treat malnutrition and for infants whose mothers were HIV-positive, sent mixed messages about the benefits of breastfeeding, thereby lowering the rates of exclusive breastfeeding (Doherty et al., 2011; Sibeko et al., 2009).

Du Plessis et al. (2016) ascribe low breastfeeding rates to the disconnect between nutritional advice and the sociocultural context in which they are implemented. Fears of milk inadequacy and reduced breast milk, and the sense that the child is hungry or not receiving appropriate nourishment, are reasons why women do not exclusively breastfeed (Du Plessis et al.,2016). Chakona (2020) found that most children in South Africa are weaned as early as two months of age, which mothers justify by claiming they are unable to produce enough breast milk for their children. Chakona (2020) also reports that mothers often believe that their milk alone is not enough for the infant, because the

child keeps crying. In South Africa, social circumstances and cultural ideas have a significant impact on breastfeeding. Chakona (2020) studied breastfeeding in five rural communities in the Eastern Cape and reported that there was a widespread belief, perpetuated by the older women in these communities, that infants should be fed water and herbal mixes, based on a misconception that breast milk contains insufficient water. However, feeding infants water is risky because it exposes them to enteric diseases and diarrhoea, especially in poor communities and rural areas where access to clean and safe water can often be limited (Guerrant et al., 2013).

Appendix A2. Relevant policies and key government documents on child nutrition and stunting

4.1. Integrated Nutrition Programme, 1996

In response to the pressing issue of malnutrition, the SA government launched the Integrated Nutrition Programme (INP) in 1994 to achieve a sustainable improvement in the nutritional condition of children, particularly those under the age of five. At its core, the programme aims to facilitate an inter-sectoral approach to solving nutrition problems in SA (The Department of Health, 1997). The effectiveness of the programme is dependent on the participation of other departments, sectors within the health department, the commercial sector, and non-profit organisations.

The INP's goals are to encourage all women to breastfeed exclusively for the first 4 to 6 months of a child's life and to maintain breastfeeding in addition to the introduction of suitable supplemental meals until the child reaches the age of 24 months and beyond.

The programme's goals include:

- To reduce malnutrition prevalence in children;
- Ensure optimal growth of infants and young children;
- Promote the health of women and particularly pregnant and lactating women;
- Improve capacity at all levels to solve the problems of malnutrition and hunger, and
- Promote inter-sectoral cooperation and community ownership of the programme and resources.

The principles and implementation mechanisms include:

- Sound nutrition for all South Africans should be encouraged as a fundamental human right as well as an intrinsic component and outcome measure of the country's social and economic development.
- Nutrition programmes should be integrated, sustainable, environmentally sound, and centred on the needs of individuals and communities, with a particular emphasis on the most vulnerable populations, particularly young children and women. The programme included a health facility-based nutrition programme30, (ii) a community-based nutrition programme and (iii) nutrition promotion in terms of communication, advocacy and legislation31.
- Nutritional wellbeing should be promoted and monitored in accordance with nationally defined objectives. A precise nutrition information strategy should be in place, providing timely, appropriate, accurate, and relevant information on a continuous basis, with a focus on actionable information.

30 Essential elements of a health facility-based nutrition programme should include Nutrition education for care givers of infants, young children and pregnant and lactating women. The emphasis should be on child feeding practices during bouts of diarrhoea, the importance of regular growth monitoring, provision of food supplementation to malnourished children, addressing micronutrient deficiencies through education and micronutrient supplementation. See also NODH (1997).

31 Priority areas of this programme communication will be (i) Breastfeeding-particularly its successful initiation, management and protection, (ii) Sound IYCF.

4.1. Landscape Analysis on Countries' Readiness to Accelerate Action to Reduce Maternal and Child Undernutrition: Nationwide Country Assessment in South Africa, 2013

The 2008 Lancet Nutrition series on maternal and child malnutrition offered an unprecedented opportunity for advocacy to expedite evidence-based nutrition action and to initiate a comprehensive harmonisation of various key actors. To maximise the effect of this opportunity and to advance the Lancet Series' findings toward intersectoral action for nutrition improvement, the Landscape Analysis (LA) served as a "readiness analysis" to systematically evaluate countries' readiness to expedite nutrition action, particularly in countries with high stunting rates: not only their readiness to act but also on their readiness to change. South Africa then undertook the analysis to identify impediments to the development of responsive solutions and prospects to scale-up effective practices. The analysis concludes that notwithstanding the strong political commitment to address maternal and child malnutrition in SA, several challenges persist, attributable to a lack of execution on some commitments. Challenges include but not limited to, different views from stakeholders on what key nutrition issues in SA are, absence of a multi-sectoral nutrition working group, lack of a nutritional surveillance system and comprehensive M&E plan, and poor use of information for decision-making processes.

The barriers to the scaling-up of nutritional-related interventions include a shortage of human resources, poor human resource capacity; demonstrated by lack of knowledge of health workers on nutrition-related policies, protocols and guidelines geared towards addressing maternal and child malnutrition, a poor perception by key actors of what nutrition problems are, and lack of strategic direction and guidance on prioritisation and implementation of evidence-based nutritional interventions that impact women and children. Additionally, several factors dilute the effectiveness of community-based nutritional programmes in SA, namely; the absence of a single model on community-based programming, the exclusion of a nutrition component in most interventions conducted by NGOs in communities, and poor performance by facilities in the matter of referral of new mothers to infant support groups following their discharge. In light of the findings, several recommendations were made, which were intended to address policy, management, and implementation-related issues. These are discussed in turn.

To address Coordination and Integration issues, the government was advised to (i) Establish coordination mechanisms in a form of a working group to reinforce coordination of key- and various role-players, (ii) Scale-up community-based nutritional interventions by improving coordination with the NGOs and other community-based organisations, and (iii) ensure the integration of effective integration to lessen maternal and child malnutrition in other programmes. In relation to the areas of Leadership, Policy, and Evidence-based Planning, the government was advised to finalise the National Nutrition policy and utilise is an advocacy tool, streamline policies on key nutritional interventions, take up the leadership role in advocating for evidence-based nutritional interventions, and scale up the implementation of such interventions to address maternal and child malnutrition. The findings also suggested several courses of action for Human resource improvement, these include inter-alia, ensuring in-service training of health workers on nutrition-related policies, guidelines and protocols, increasing the number of nutrition personnel with appropriate skills at the PHC, and strengthening the capacity of nutrition managers at various spheres of government, to utilise allocated funds on key nutritional interventions. Finally, the development of an M&E evaluation plan to monitor the implementation of nutritional interventions.

4.2. Roadmap for Nutrition in South Africa 2013-2017

As summarised in the first section, the 1994 INP laid the groundwork for the reorientation of nutrition services in South Africa since 1994. The Nutrition Roadmap is based on the recommendations of

recent evaluations of the implementation of the INP, particularly the Landscape Analysis (NDOH, 2013). It presents a framework for elevating the prominence of nutrition and nutrition-related issues and actions in the health system, with an emphasis on developing a strategic plan that focuses on priority target groups and interventions that have the greatest impact, particularly during the life-cycle stages before and during pregnancy, as well as during the first two years of a child's life (from gestation to 24 months). As part of its overall goals, the Roadmap has set out to promote optimal growth of children, by focusing on optimal infant and young child nutrition, with an emphasis on a lifecycle approach that targets the window of opportunity[32]. It proposes nutritional strategies in the areas of behavioural change, micronutrient and deworming, therapeutic feeding, and community-based services. The proposed key nutrition interventions are discussed in turn.

The comprehensive package of nutritional interventions explains the implementation of key nutritional interventions to reach vulnerable groups using a variety of delivery platforms, as well as current nutrition-related frameworks and guidelines that may be incorporated into the interventions. The proposed key nutritional interventions include:

- Counselling on appropriate IYCF: promotion of exclusive breastfeeding and improvements in complementary with continued breastfeeding
- Counselling and education on optimal maternal nutrition: healthy eating for optimal weight management during pregnancy and lactation
- Targeted supplementary feeding: Maternal supplementation during pregnancy (iron folate and calcium supplementation), infant nutrient supplementation (Vitamin A and therapeutic zinc supplementation) and promotion of therapeutic feeding for children who are severely acute malnourished
- Growth monitoring and promotion: strengthening the human resource base to enable more accurate detection of malnutrition and stunting
- Reinforcement of community-based nutrition interventions: ensuring active participation of CHWs, support for pregnant and lactating women, and support for ECD centres

The proposed strategic approaches are: (i) sustained advocacy for nutrition integration into relevant sector strategies and programs, (ii) strategic positioning of nutrition within the health sector, (iii) Reinforcement of implementation of interventions across all spheres of the health sector, (iv) strengthening the human resource base, and (v) Improving the information base through providing timely, appropriate, accurate, and relevant nutrition-related information on a continuous basis, with a focus on actionable information and attempts to minimise action paralysis, to provide efficient nutrition services. In each instance, the focus is on providing high-quality services to vulnerable populations.

4.3. National policy on food and nutrition security, 2013

The National Food and Nutrition Security Policy's declared objective is to promote the national and household availability, accessibility, and affordability of safe and nutritious food. The policy states that it expands on current programs and processes and establishes procedures to guarantee greater alignment, coordination, and supervision. Additionally, the policy aims to provide an ambitious, thorough, and dynamic response to food and nutrition insecurity. As a result, the policy establishes a foundation for a variety of strategies, which includes the following:

- Increased and more focused government investment on social initiatives affecting food security;
- Efforts to boost food production and distribution, including better access to inputs for the developing agricultural industry;
- Utilising public procurement to assist community-based food production projects and smallholder farmers; and

32 Pregnancy and the first two years of life (the first 1000 days).

- The prudent use of market interventions and trade policies to advance food security.

Anthropometric indicators, such as height-for-age for the diagnosis of stunting, are discussed under the section on indicators for measuring food and nutrition security. There is no explicit description of the tasks or procedures for collecting this data, and hence no accountability is assigned. In this regard, the policy falls short of going beyond expressing the necessity for a food and nutrition security strategy and outlining its characteristics.

4.4. Infant and young child feeding policy, 2013

This policy replaced the 2007 policy and incorporated the renewed 2010 WHO guidelines on HIV and infant feeding. The aim of the policy is to promote optimal nutritional status, growth, development and improve health and child survival outcomes of infants and young children in South Africa.

Most notably, it recommended breastfeeding for mother living with HIV. It also actively promoted breastfeeding, recommending early initiation of breastfeeding and continued breastfeeding for at least two years.

The primary beneficiaries are infants (0-12 months) and young children one to five years. In its own words the policy's objectives are:

- To provide evidence-based information on appropriate infant and young child feeding, including in the context of HIV, to health care personnel to enable them to support pregnant women and mothers of infants and young children
- To strengthen strategies for increasing the rates of exclusive breastfeeding namely: Mother-Baby Friendly Initiative (MBFI), Kangaroo Mother Care (KMC), human breastmilk banking and Code implementation
- To promote timely introduction of adequate, safe and appropriate complementary foods with continued breastfeeding
- To define strategies on feeding infants and young children in all settings including exceptionally difficult circumstances
- To advocate for creation of supportive environments, including in the work place, that will enable mothers to breastfeed exclusively for the first six months and to sustain breastfeeding
- To standardise and harmonise messages relating to infant and young child nutrition

Appendix A3. Relevant policies on ECD, nutrition and food safety

5.1. The National Integrated ECD (Early Childhood Development) policy, 2015

This policy is geared towards transforming ECD-service[33] delivery in South Africa. Specifically, to address significant gaps and to ensure the provision of a comprehensive, widely accessible, and equitable ECD services. Several ECD services are not widely accessible or equitable, and face quality issues. This includes, among others, food and nutrition support. The situational analysis outlines that, inter alia, the high level of poor nutrition among young children is a pressing issue[34]. Poor child nutrition outcomes in South Africa are due to ineffective programme execution as well as programmatic gaps. Notably, present programs do not provide appropriate food for children with growth failure, nor do they provide effective malnutrition prevention through targeted preventative

33 Early Childhood Development Services

34 Child malnutrition is a major challenge in South Africa. Micronutrient deficiencies, particularly Vitamin A deficiency, are also a matter of concern.

interventions aimed at pregnant women and infants, nor do they provide broad public prevention communication. Nutritional support is essential for women from conception and during gestation, as well as for infants and young children[35]. This summary focuses primarily on what policy establishes around child nutrition.

Against this background, the government pledges to provide ECD services that include a number of new services as an integral part of the comprehensive ECD programme to fill the gaps recognised in the range of services available, such as (i) food and nutritional support offered by CHWs for pregnant women and young children at risk, (ii) micronutrient and food supplementation, with a special focus on underweight pregnant women and children who fail to thrive due to poverty and associated social difficulties, as well as (iii) an enhanced parenting support programme, which includes preparing pregnant mothers and partners, as well as mothers of young children, to enable them to optimise their children's development across all domains, particularly in the areas of food and nutrition, provision of positive parenting practices, among others.

The policy emphasises health care and nutrition programs as a critical component that must be prioritised, as well as an important conduit via which the aforementioned services can be provided. Health and Nutrition programs as an essential component include the provision of the following:

- The promotion and support of exclusive breastfeeding for the first 6 months following birth
- Counselling to encourage adequate and responsive complementary feeding or alternatives to breastfeeding in the case that breastfeeding is not possible, as well as obesity prevention.
- Micronutrient supplements (folic acid and iron for pregnant women, and Vitamin A supplementation for infants and young children) and dietary supplementation for underweight pregnant women and children who are unable to thrive due to poverty and related socioeconomic difficulties.
- Community outreach workers, including CHWs from the Department of Health, provide food and nutritional support to pregnant women and young children.

The Department of Health, in conjunction with the Departments of Social Development, Agriculture, Basic Education, and the Presidency, will facilitate the review and strengthening of an inclusive strategy that will include participation by all government and non-government role players responsible for providing relevant food and nutrition services to young children and their families. The strategy will establish the necessary responsibilities and players in order to address the food and nutritional needs of pregnant women and young children. It will provide guidance for the fulfilment of their tasks and obligations, as well as provide systems for accountability of multi-sectoral role players in terms of their responsibilities for achieving the intended objectives.

The following will be ensured by the strategy:

- Development of norms and standards, meal plans, and training curricula for early childhood development practitioners in order to provide nutritionally balanced food through early childhood development programs.
- Improved food production and security by promoting and supporting food gardens in households with infants and young children, as well as early childhood development programs based on a specific site, where possible, with an emphasis on growing crops with high nutritional value and poultry and livestock ownership.
- Improved food security and access to nutritious foods in households with pregnant women, infants, and young children, including through food price stabilisation, income generation, and access to social security grants, among other things.
- Improved access to environmental health services, such as piped water, sanitation, and refuse

35 It has been well documented in the literature that poor baby and child nutrition, particularly between the ages of conception and 2 years, can result in irreversible developmental stunting and delays, as well as poor cognitive development and, eventually, sub-optimal educational and labour market performance. A shortage of folic acid in the early gestational period, for example, can cause considerable structural harm to the foetus in utero.

management that are essential for the nutritional health and development of infants and young children.
- Formulation and execution of a multi-sectoral food and nutrition communication and education campaign with an emphasis on the prevention of malnutrition, hunger, and stunting in pregnant women, infants, and young children; and an establishment of an integrated nutrition information system and integration of current household profiling activities with the system.

5.2. The Children's Amendment Act, 2007

This Act amends the Children's Act, 2005, so as to insert certain definitions; and among other things, to provide for partial care of children; to provide for early childhood Development; to provide for children in alternative care; to provide for foster care and to provide for child and youth care centres and drop-in centres. The focus of this summary is primarily on what policy establishes around child hygiene. In the Act, the only settings where hygiene is stressed are drop-in centres and partial care facilities.

A drop-in centre is a facility that provides basic services targeted at addressing the emotional, physical, and social development requirements of vulnerable children. It must provide at least one of the following fundamental services: Food, school attendance support, personal hygiene assistance, or laundry services.

National norms and standards for drop-in centres include

- A safe environment for the children;
- Safe drinking water;
- Hygienic and adequate toilet facilities;
- Access to refuse disposal services or other adequate means of disposal of refuse generated at the facility; and
- A hygienic area for the preparation of food for children

The owner or manager of the drop-in centre only qualifies for registration, application approval, and funding if the centre, among other things, complies with the requirements as stipulated above, and the structural, safety, health requirements of the municipality. Additionally, the funding of such centres in prioritised in communities where families lack the means of providing proper shelter, food and other basic necessities of life to their children. Failure to comply with the national norms and standards of drop-in centres may result in cancellation by written notice to the registration holder.

A partial care facility is one where a person, for or without remuneration, looks after more than 6 children on behalf of their parents or caregivers during particular hours of the day or night, or for a limited time, as agreed upon between the parents or caregivers and the service provider. It excludes the care of a child- (i) by a school as part of tuition, or any other activities provided by the school, (ii) as a boarder in a school hostel or other residential facility managed as part of the school or (iii) by a hospital or medical facility as part of medical treatment provided to the child.

National norms and standards for partial care include

- Safe drinking water;
- Hygienic and adequate toilet facilities;
- Access to refuse disposal services or other adequate means of disposal of refuse generated at the facility; and
- A hygienic area for the preparation of food for children


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