Original Article

Situational analysis of infant and young child nutrition policies and programmatic activities in Mali

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Abstract

Progress towards reducing mortality and malnutrition among children <5 years of age has been less than needed to achieve related Millennium Development Goals. Therefore, several international agencies joined to 'Reposition children's right to adequate nutrition in the Sahel', starting with a situational analysis of current activities related to infant and young child nutrition (IYCN). The main objectives of the situational analysis are to compile, analyse and interpret available information on infant and young child feeding, and the nutrition situation of children <2 years of age in Mali, as one of the six targeted countries. Between June and September 2008, key informants responsible for conducting IYCN-related activities in Mali were interviewed, and 117 documents were examined on the following themes: optimal breastfeeding and complementary feeding practices, prevention of micronutrient deficiencies, screening and management of acute malnutrition, prevention of mother-to-child transmission of HIV, food security, and hygienic practices. Most of the key IYCN topics were addressed in national policies, training materials, and programme documents. Information on the national coverage and impact of these programmes is generally not available. Exclusive breastfeeding (<6 months) has increased in Mali, but no studies identified the contributors to this increase. Despite improvements in breastfeeding practices, optimal infant, and young child feeding is still practiced among too few young children in Mali. Several research articles were identified, but few of these were linked to programme development. Some programme monitoring and evaluation reports were available, but few of these were rigorous enough to identify whether IYCN-specific programme components were implemented as designed or were achieving desired outcomes. Therefore, we could not confirm which programmes contributed to reported improvements. Monitoring of programmes managing malnutrition identified gaps in human and institutional capacities to fully carry out intended interventions and the government has recognized the overall lack of adequate numbers of health care providers to carry out necessary programmes in Mali, of which nutrition programmes are a part. The policy and programme framework is well established for support of optimal IYCN practices, but greater resources and capacity building are needed to: (i) conduct necessary research to adapt training materials and programme protocols to programmatic needs; (ii) implement rigorous monitoring and evaluation that identify effective programme components; and (iii) apply these findings in developing, expanding, and improving effective programmes.

Keywords: infant and young child nutrition, national policies, nutrition programmes, monitoring and evaluation, West Africa, Mali.

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Background

Mali is a land-locked country of 1.2 million square kilometres, bordered by Mauritania, Algeria, Niger, Burkina Faso, Ivory Coast, Guinea, and Senegal (1) (Fig. 1). Among the 13.7 million inhabitants, 48% are less than 15 years of age. The GDP per capita was estimated at 1200 USD in 2008 with 36% of the population living below the poverty line (2005 estimate) (2). The main livelihoods relate to agriculture and fishing (80%) with about 15% of adults unemployed. Mali is divided into eight administrative regions and the capital district of Bamako. Population density ranges from 90 inhabitants per square kilometre in the central Niger River delta region, which cuts generally east-west across the south of the Sahara, to less than five in the northern desert

region. The primary export is cotton, followed by livestock and gold.

The three climatic zones in Mali include, moving from north to south: (i) arid Sahara desert covering two-thirds of the country in which there is less than 127 mm; annual rainfall; (ii) the Sahelian region that is relatively dry; and (iii) the subtropical zone with 1400 mm rainfall annually. Population sub-groups have developed specific livelihoods that are sustainable in these climatic zones: nomads and transhumant pastoralists, agro pastoralists, fishers, and large or small food and/or cash crop producers (3) (Fig. 1).

Mali is dependent on foreign aid, and the national economy is vulnerable to yearly and seasonal variations in rainfall and in international fluctuations in the cotton market. Periodically, these variations have

Fig. 1. Map of Mali. Courtesy of the United Nations Office for the Coordination of Humanitarian Affairs, Regional Office for West and Central Africa.

had devastating effects on the Malian economy. For several years Mali has also faced security issues in the Kidal region, on the north-east border with Algeria, that temporarily prevent the population from accessing adequate food, health, and other services.

Although some improvements have occurred in increasing rates of exclusive breastfeeding and reducing mortality rates among infants and young children,

these and other efforts have had little effect on anthropometric indicators among preschoolers (Fig. 2). The prevalence of underweight among children <24 months decreased from 35 to 30% between 1995/1996 and 2001, but has remained around 30% since then. The prevalence of stunting has actually increased during this same time from 23% in 1995/1996 to 27% in 2001 and 2006. As demonstrated in Fig. 2, these changes are not on track towards the

Fig. 2. Mali – trends (%) in underweight and stunting ~1990–2006, among infants and children <5 years, dotted line indicates target trajectory for Millennium Development Goal (MDG) 1.8: to reduce hunger by half from 1990 to 2015. (a) MDG trend in underweight <-2 weight-for-age z-score. 2015 goal is one-half the 1996 prevalence in the absence of 1990 values. (b) Stunting and wasting trends. Figure depicts data reported in Demographic and Health Surveys in 2001 and 2006. WAZ, weight-for-age z-score according to WHO 2006 Child Growth Reference reference data, indicator of global acute malnutrition (GAM); HAZ, length-for-age <-2 z-score; WHZ, weight-for-length <-2 z-score.

Fig. 3. Mali – under-5 mortality rate: 1990 estimate; 1995, 2001, and 2006 Demographic and Health Survey (DHS); 2015 goal, dotted line indicates target trajectory for Millennium Development Goal (MDG) 4.1: to reduce mortality rates by two-thirds. Data sources: 1990 estimate from <http://www.childmortality.org/>; 1995/1996, 2001, and 2006 from DHS; 2015 goal is one-third of 1990 estimate.

Millennium Development Goal (MDG) #1.8 to halve underweight among young children by 2015.

Mali is also lagging behind the necessary trajectory to reach MDG #4. Although the mortality rates among children <5 years of age decreased from 250 to 191 per 1000 live births between 1990 and 2006 (Fig. 3), these rates are still well above the reduction required to reach MDG #4.1: to reduce the mortality rates among children less than 5 years of age by two-thirds between 1990 and 2015.

The primary responsibility for infant and young child nutrition (IYCN) activities rests within the Division of Nutrition (DN) of the Malian Ministry of Health under the National Direction of Health. The DN is divided in two sections focusing on: (i) the Promotion of feeding practices and nutrition education; and (ii) the Prevention and fight against micro-nutrient deficiencies. A number of other divisions or sections in the Ministry of Health are conducting IYCN activities, such as the National Centre of Health Information, Education and Communication (CNIECS in French), the Planning and Statistical Unit of the Ministry of Health, the Centre of Research, Study, and Documentation on Child Survival, the National Institute of Health and Sciences Training, and the National Institute of Public Health Research. Other governmental ministries conducting IYCN activities include the Ministry of Agriculture and the Ministry of Higher Education and Scientific Research (MSRS). There is a national nutrition

council that meets *ad hoc* to organize and review national nutrition-related activities, but these meetings have not been formalized to facilitate regular coordination of nutrition-related activities in Mali.

The main objectives of the situational analysis are to compile, analyse, and interpret available information on infant and young child feeding, and the nutrition situation of children <2 years of age in the six target countries (Burkina Faso, Chad, Mali, Mauritania, Niger, Senegal). Additional aims are to identify inconsistencies with international recommendations and gaps in programme activities, and to provide recommendations based on these findings to guide the development of more effective IYCN-related programmes and activities.

Methods

Between June and September 2008, the in-country coordinator of this situational analysis contacted 21 organizations known to be involved in nutrition and health-related activities. Participating organizations completed a questionnaire regarding their IYCN activities and shared 117 pertinent documents that we reviewed for inclusion in this analysis (see Supporting Information Appendix S1). Unfortunately, all relevant documents from these agencies were not available for review, and some activities conducted by these organizations might not have been documented in formal reports. Therefore, the analyses are limited

to those documents we were able to obtain. It would have been beyond the scope of these analyses to include all documents regarding HIV, food security, and hygiene. Therefore, we focused on respective activities that targeted infants and young children. We found few food security programmes with specific activities targeted at young children. Because the family's food security status has an impact on the health and nutritional status of young children, we provide a brief overview of food security tracking that is taking place in-country.

The documents reviewed include information on: (i) national policies, strategies, and plans of action; (ii) formative research studies, including studies of barriers and beliefs concerning IYCN-related behaviours and peer-reviewed research relevant to programme development; (iii) training materials, programme protocols and curricula; (iv) programmes implemented, with the intended and actual programme coverage, where available; and (v) programme monitoring and evaluation reports, including available survey results. The topics we reviewed in these documents included: breastfeeding and complementary feeding practices, prevention of micronutrient deficiencies, management of acute malnutrition, prevention of mother-to-child transmission (MTCT) of HIV, food security, and hygienic practices. The criteria for selecting these topics and the international recommendations used in comparisons, are outlined in the introductory chapter in this issue (4). Reported activities and gaps in information are discussed in the following sections by feeding practices or other related activities, in the order found in Table 1. For the purposes of this paper, surveys are considered cross-sectional assessments of the prevalence of given indicators in national or smaller populations, monitoring includes programme-specific assessments of activities such as programme coverage, training, activities implemented, whether appropriate messages are provided to and remembered by care givers, and evaluations include programme-specific impact assessments. Due to the number of activities and documents reviewed, we were only able to discuss the most relevant activities in this publication. Summary tables of additional activities and documents identified are

listed in Supporting Information Appendix S1 by type of document reviewed.

Results

The findings of our analyses are summarized in Table 1 by feeding practices promoted, and by other nutrition-related activities (rows) and by type of document reviewed with programme coverage and some related nutrition statistics (columns). The section on breastfeeding (Promotion of optimal infant and young child feeding practices) provides examples on how to interpret the information in Table 1, and the contents are further explained in Table 1's footnotes. The majority of activities identified in our review are joint activities between the relevant governmental agencies and international or national non-governmental organizations and/or United Nations agencies. We found little information on the actual human and institutional resources available to implement nutrition aspects of programmes, how well individual educational messages were promoted by facility staff or whether participants were applying messages received. Therefore, this table and this situational analysis are lacking the depth of information that we hoped to find in commencing this process.

Promotion of optimal infant and young child feeding practices

Breastfeeding

National policies, strategies, and plans of action

The three key breastfeeding practices of timely introduction of breastfeeding within the first hour of birth, exclusive breastfeeding to 6 months and continued BF to 24 months are specifically and correctly addressed in one or more of the national policies and strategies (5–9), in addition to promotion of the Baby Friendly Hospital Initiative and the International Code for the Marketing of Breast Milk Substitutes (Code) (7). The checkmarks in Table 1 in the cells under the column for 'policies' and the three rows for breastfeeding thus indicate that these practices are clearly identified in national policies.

Table 1. Mali – summary of actions documented with respect to key infant and young child feeding practices (explanations found at the end of the table)

Key practice*	Summarized findings by type of document reviewed, with selected national-level findings†							
	Policies	Formative research	Training materials	Programmes	Intended programme coverage	Actual programme coverage	Programme monitoring	Survey/ evaluation
Promotion of optimal feeding practices								
Timely introduction BF, 1 h	✓	✓	✓	✓	National	Sub-national	(✓)‡	46%§
EBF to 6 months	✓	✓	✓/–✓	✓	National	National	(✓)	24%¶
Continued BF to 24 months	✓	✓	✓	✓	National	Sub-national	(✓)	56%**
Introduce CF at 6 months	✓	✓	✓/–✓††	✓	National	Sub-national	(✓)	26%‡‡
Nutrient dense CF	N/I	N/I	✓	✓	National	Sub-national	(✓)	17% VA§§ 21% MFPE¶¶
Responsive feeding	N/I	N/I	✓	✓	National	Sub-national	(✓)	N/I
Appropriate frequency/consistency	(✓)	(✓)***	✓	✓	National	Sub-national	(✓)	<30%†††
Dietary assessments to evaluate consumption	N/I	(✓)	N/I	n/a	n/a	n/a	n/a	(✓)‡‡‡
Prevention of micronutrient deficiencies								
Vitamin A supplements young children	✓	✓	✓	✓	National	72%§§§	✓/DHS	N/I
Postpartum maternal vitamin A supplementation	✓	✓	✓¶¶¶	✓	National	41%****	✓/DHS	16%††††
Zinc to treat diarrhoea	✓	✓	✓	✓	Sub-national	Sub-national	✓	N/I
Prevention of zinc deficiency	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I
Anaemia prevention (malaria, parasites)	✓	(✓)‡‡‡‡	✓	✓	National	National	37% IYC 16%preg§§§§	81% IYC <11 g dL¶¶¶¶
Anaemia prevention (iron/folic acid in pregnancy)	✓	✓	✓	✓	National	National	18%*****	68% women <11 g dL–†††††
Assessment of iron deficiency anaemia	(✓)	(✓)	(✓)	(✓)	N/I	N/I	N/I	(✓)‡‡‡‡‡
Iodine programmes	✓	✓	✓	✓	National	Iodized salt in 79% homes	✓	✓
Other nutrition support								
Management of malnutrition	✓	(✓)/✓	✓	✓	National	N/I	✓	15% WHZ 27% WAZ 38% HAZ§§§§§
Prevention MTCT HIV/AFASS	✓	N/I	(✓)	✓	Sub-national	Sub-national	N/I	47%¶¶¶¶¶
Food security	✓	N/I	N/I	✓	National	National	N/I	✓
Hygiene and food safety	(✓)	✓*****	(✓)	(✓)	National	N/I	46%†††††† 11% HH‡‡‡‡‡‡	N/I
Related tasks								
IEC/BCC in programmes§§§§§§	✓	✓	✓	✓	Sub-national	Sub-national	N/I	✓

EXPLANATION OF TABLE HEADERS AND MARKINGS:

✓ Confirmed documentation of actions specific to these key practices.

N/I No documentation of the activity was provided or identified.

(✓) Actions more generally related to the key practices, but without referencing the practice specifically.

–✓ Practice that is addressed but that is not specifically consistent with international norms – e.g. in case of anaemia: haemoglobin assessments are used and these cannot distinguish the cause of the anaemia, but treatments only address iron deficiency anaemia.

n/a Not applicable

Key Practices and Related Activities As Outlined in Textbox 1 of the Detailed Methods Paper in This Issue (4).*Timely introduction of breastfeeding, 1 h**, commencement of breastfeeding within the first hour after birth.**EBF to 6 months**, Exclusive Breast Feeding, with no other food or drink, other than required medications, until the infant is 6 months of age.**Continued BF to 24 months**, continuation of any breast feeding until at least 24 months of age as complementary foods (CF) are consumed.**Initiation of CF at 6 months**, gradual commencement of CF at 6 months of age.**Nutrient dense CF**, promotion of CF that are high in nutrient density, particularly animal source foods, and other foods high in vitamin A, iron, zinc.**Responsive feeding**, encouragement to assist the infant or child to eat and to feed in response to hunger cues.**Appropriate frequency/consistency**, encouragement to increase the frequency of CF meals or snack as the child ages (two meals for breastfed infants 6–8 months, three meals for breastfed children 9–23 months, four meals for non-breastfed children 6–23 months, ‘meals’ include both meals and snacks, other than trivial amounts, and breast milk), and to increase the consistency as teeth erupt and eating abilities improve.

Table 1. Footnote Continued

Dietary assessments to evaluate consumption, indicates whether dietary assessments are being conducted, particularly those that move beyond food frequency questionnaires.

Vitamin A supplements young children, commencement of vitamin A supplementation at 6 months of age and repeated doses every 6 months.

Postpartum maternal vitamin A, vitamin A supplement to mothers within 6 weeks of birth.

Zinc to treat diarrhoea, 10 mg day⁻¹ for 10–14 days for infants and 20 mg day⁻¹ for 10–14 days for children 12–59 months.

Prevention of zinc deficiency, provision of fortified foods or zinc supplements to prevent the development of zinc deficiency among children >6 months.

Anaemia prevention (malaria, parasites), iron/folate supplementation during pregnancy, insecticide treated bed nets (ITNs) for children and women of child-bearing years, anti-parasite treatments for children and women of child-bearing years.

Assessment of iron deficiency anaemia, any programme to go beyond the basic assessment of haemoglobin or haematocrit to assess actual type of anaemia, such as use of serum ferritin or transferrin receptor to assess iron deficiency anaemia.

Iodine programmes, promotion of the use of iodized salt; universal salt iodization or other universal method of providing iodine with programmes to control the production and distribution of these products.

Management of malnutrition, diagnosis of the degree of malnutrition, treatment at reference centres/hospitals for severe acute malnutrition and appropriate follow-up in the community, or local health centre; or community-based treatment programmes for moderately malnourished children.

Prevention MTCT HIV/AIDS, appropriate anti-retroviral treatments for HIV + women during and following pregnancy to avoid transmission to the infant, exclusive breastfeeding to six months, breast milk substitutes only when exclusive breastfeeding is not possible. Substitutes should be Acceptable, Feasible, Affordable, Sustainable and Safe (AFASS), weaning should be gradual or EBF should be followed by partial breastfeeding depending on the risk factors [see text box 4 of the detailed methods paper in (4)].

Food security, programmatic activities with impact on infant and young child nutrition (IYCN), including agency response to crises, tracking markers of food security, and food aid distributions.

Hygiene and food safety, all aspects of appropriate hand washing with soap, proper storage of food to prevent contamination, and environmental cleanliness, particularly appropriate disposal of human wastes (latrines, toilets, burial).

***CATEGORIES OF ACTIONS UNDER WHICH THE KEY PRACTICES WERE CORRECTLY ADDRESSED.**

Policies, nationally written and ratified policies, strategies, or plans of action.

Formative research, Studies that specifically assess barriers and beliefs among the target population regarding each and/or bibliographic survey of published studies related to programme development, as identified through PubMed search of 'nutrition' plus either 'child' or 'woman' plus the name of the country and/or by key informant.

Training/curricula, programme protocols, university, or vocational school curricula or other related curricula that specifically and correctly addresses each desired practice, these include pre- and in-service training manuals.

Programmes, documented programmes that are functioning at some level that are intended to specifically address each key practice listed.

Intended programme coverage, the level at which the programme is meant to be implemented, according to programme roll-out plans.

Actual programme coverage, the extent of programme implementation that was confirmed in one of the received documents.

Programme monitoring, monitoring activities that are conducted for a given programme that specifically quantify programme coverage, training, activities implemented, whether messages are given to and/or retained by care givers, etc.

Surveys and evaluations, studies that have been conducted to evaluate changes in specific population indicators in response to a programme and/or cross-sectional surveys.

ADDITIONAL EXPLANATIONS

*ACF-IEC study evaluated TIBF, but did not compare change in intervention with change in non-intervention (breastfeeding section Surveys, monitoring, end evaluation, under Results). [†]Per cent of children <24 months who were reportedly put to the breast within the first hour after birth, Demographic and Health Survey (DHS) 2006. [‡]Per cent of infants 4–5 months who were exclusively breastfed the day prior to the survey, DHS 2006. [§]Per cent of children 20–23 months who were breastfed the day prior to the survey, DHS 2006. ^{||}Some curricula confuse commencing breastfeeding at 6 months (or in the 7th month) with commencing in the 6th month or at 7 months. [¶]Per cent of children 6–7 months reportedly consuming complementary foods, DHS 2006. ^{‡‡}Per cent of children 6–24 months who reportedly consumed a vitamin A rich fruit or vegetable during the day prior to the survey, DHS 2006. ^{§§}Per cent of children 6–24 months who reportedly consumed meat, fish, poultry, or egg during the day prior to the survey, DHS 2006. ^{***}Studies conducted to evaluate the acceptability of altered consistency complementary foods. ^{†††}Per cent of children 6–24 months reportedly consuming at least the recommended number of meals, by age, during the 24 h prior to the survey (the minimum recommended number of meals and substantial snacks for breastfed children is 2/day at 6–8 months, 3/day at 9–23 months, and for non-breastfed children is 4/day at 6–23 months), DHS 2006. ^{††††}Dietary data collected in the DHS 2006 included groups of foods consumed, but no quantities of these foods. ^{§§§}Per cent of children 6–59 months who received vitamin A supplement in the 6 months prior to the survey, DHS 2006. ^{§§§§}Most training materials recommend providing vitamin A within 6 weeks postpartum, but some recommend within 8 weeks postpartum. ^{*****}Per cent of women with pregnancies in the previous 5 years who reportedly received vitamin A supplement in the 2 months postpartum, for the most recent pregnancy, DHS 2006. ^{†††††}Per cent of women with pregnancy in the previous 5 years who reported having night blindness during the last pregnancy, DHS 2006. ^{§§§§§}Bed nets in one area were used year round, particularly as 'conjugal beds', INRSP/ECHO/Oxfam 2008. ^{§§§§§}Per cent of children or pregnant women who reportedly slept under an insecticide-treated bed net during the night prior to the survey, DHS 2006. ^{§§§§§}Per cent of children 6–59 months with anaemia, whole blood haemoglobin <11 g dL⁻¹; iron deficiency anaemia not measured, DHS 2006. ^{*****}Per cent of women who reported consuming at least 90 days of iron-folic acid supplement during her last pregnancy that occurred in the prior 5 years, DHS 2006. ^{†††††}Per cent of women 15–49 years with anaemia, whole blood haemoglobin <11 g dL⁻¹; iron deficiency anaemia not measured, DHS 2006. ^{§§§§§}Measured haemoglobin, as shown above, and iron deficiency anaemia measured in anaemic school-aged children, see text under iron and anaemia. ^{§§§§§}Per cent of children <5 year with z-scores <-2, weight-for-height (WHZ), weight-for-age (WAZ), height-for-age (HAZ) by WHO Growth Reference Standards, as reported in DHS 2006. ^{§§§§§}Per cent of women 15–49 reporting knowledge that HIV can be passed mother to infant by breastfeeding, as reported in DHS 2006. ^{*****}Reported beliefs: soap is too expensive and latrines are not used frequently enough to be worth building, INRSP/ECHO/Oxfam 2008. ^{†††††}Per cent of households reportedly disposing of a child's excrements/human wastes in a hygienic manner (toilet, latrine, or buried), DHS 2006. ^{§§§§§}Per cent of households have access to a hygienic method of disposing of human wastes (toilet, latrine), DHS 2006. ^{§§§§§}Specific references found for two programmes: an IEC programme by ACF and the An Bè Jigi programme by HKI/ICRISAT/IER (Helen Keller International/ICRISAT – International Crops Research Institute for the semi-arid Tropics/IRD: Institute de Recherche pour le Développement); the evaluations for the latter not yet completed.

In 1978, a decree was adopted to grant women 14 consecutive weeks of maternity leave following the infant's birth (10) and legislation written in 1992 gives mothers the right to one hour per day at work to breastfeed during an infant or child's first 15 months of life. A Malian version of the international Code was has been adopted (11), but it does not match the international Code. According to the National Infant and Young Child Feeding Strategy (5), there is also a national committee charged with the promotion of exclusive breastfeeding in Mali, but documentation was not available.

Research

Due to the importance of adapting educational messages and programmes to local needs, we searched for studies that identified local barriers and beliefs related to the promoted breastfeeding practices. We found five studies that addressed knowledge and beliefs regarding breastfeeding practices (12–15), the majority of which were conducted in conjunction with a programme. These studies highlighted some positive and negative beliefs, such as beliefs that infants put to the breast immediately at birth are more intelligent than those who wait, contrasted by other beliefs that colostrum can cause diarrhoea in the infant and breast milk is not adequate for infants, even in the first few months. Although some following programme documents discussed that educational messages were developed based on these findings, these documents did not include the educational messages that were apparently developed. The checkmarks in the column for studies on 'formative research' in Table 1 reflect these findings. However, these findings are not nationally representative. Some of these topics were also addressed generally in the national Behaviour Change Communication (BCC) strategy (6), but we could not confirm how these messages are being used in BCC activities.

Training manuals, programme protocols, and curricula

All three key breastfeeding practices are promoted in national-level training materials (16–20). Thus, these cells in Table 1 under the column for training materials are filled with checkmarks. However, because

some manuals are still in use that promote breastfeeding to ages other than the currently recommended 6 months, the cell for exclusive breastfeeding also includes a checkmark preceded by a negative sign. The Essential Nutrition Actions (ENA) provide guidance on BCC techniques as one method of implementing the national BCC strategy.

Programmes

Most of the key breastfeeding practices are addressed nationally through individual programmes or a combination of programmes implemented in various regions (8, 12–15, 21–27). The annual or semi-annual week of intensified nutrition activities, *Semaine d'Intensification des Activités de Nutrition* (SIAN) and week of breastfeeding promotion (SMAM) national campaigns include components promoting exclusive breastfeeding. Other programmes were only confirmed in certain regions of Mali (see Supporting Information Appendix 1), the largest of which was the accelerated strategy for child survival and development (SASDE in French) project (8) commenced in 2002 in four regions, with plans to expand nationally as the Child Surveillance Strategy (SSE in French) and through promotion of the ENA approach. All three of the key breastfeeding practices are incorporated into the SASDE and the ENA approach. As with the training materials reviewed, some programmes still promote exclusive breastfeeding to just 4–6 months, so the checkmarks in these cells are similar to those under training materials in Table 1. The SIAN, SMAM, SSE, and ENA approach are intended for national coverage, but breastfeeding promotion, beyond exclusive breastfeeding to 6 months, was only confirmed in some regions. Therefore, the intended programme coverage is listed as 'national', but the actual coverage is listed as 'sub-national', except for the promotion of exclusive breastfeeding through SIAN/SMAM campaigns.

We found two small-scale programmes in which educational messages were expanded to target grandmothers, who were found to play key roles in decision-making regarding feeding practices (22, 28, 29). No evaluations were yet available of this aspect of the programme.

Surveys, monitoring, and evaluation

One example of monitoring activities identified is found in the SASDE report (8), which included whether appropriate staff had received training, the number of recipients visiting the centres, whether group education sessions were implemented, and the general topics covered in education sessions. They found a critical gap in nutrition education of health agents. Only 11% had received any theoretical or theoretical plus practical training in nutrition and only 22% had received training on information education communication (IEC) in compliance with the national BCC strategy (8). However, from the data available, it was not possible to determine which key practices were addressed during education sessions and whether the participants retained and/or implemented the information provided.

The best example of programme evaluations was an evaluation of the impact of educational messages to promote optimal breastfeeding messages in three intervention and one non-intervention site (14). The change in per cent of infants that were put to the breast during the first hour after birth in the intervention sites ranged from almost no change to a fivefold increase. They also found a 36% increase in the non-intervention site. Unfortunately, they did not compare the overall change in intervention with non-intervention sites, and did not give explanations for the wide variations in the non-intervention sites. Further,

because it was a 6-month intervention, the changes in seasons could have explained some of the differences observed. Therefore, they could not confirm whether the intervention was better than non-intervention at improving this breastfeeding practice.

Because the identified monitoring reports did not directly evaluate whether programme components were being implemented correctly, the checkmarks in the cells in Table 1 under 'programme monitoring' are in parentheses for the three breastfeeding practices. For consistency across country reports and because no programme evaluations were adequate to confirm programme impacts, the data reported in the last column of Table 1, 'survey/evaluation' reflect findings from the latest Demographic and Health Survey (DHS).

The DHS reports do not provide standard errors for adequate comparison across years. However, the substantial increases reported in optimal breastfeeding practices since 1995 (Figs 4, 5) certainly identify actual improvement. The per cent of infants who were reportedly put to the breast in the first hour after birth more than tripled, as did the per cent of children less than 6 months of age who are exclusively breastfed (30, 31). However, due to a lack of rigorous programme evaluations as just described, it is not clear whether these increases are due to the programmes implemented.

Although considerable progress has been achieved, there is much work remaining to attain the

Fig. 4. Mali – breastfeeding practices, as measured over time in DHS surveys, per cent of infants or children by category and year*: Initiation of breastfeeding in the first hour (TIBF), exclusive breastfeeding (EBF) at 4–5 months, and continued breastfeeding or partial breastfeeding (BF) at 23 months. *Data collected among infants and children <24 months living with their mothers during Demographic and Health Surveys in 1995–1996, 2001 and 2006, figure courtesy of United Nations Children's Fund West and Central Africa Regional Office.

Fig. 5. Mali – Per cent of children, by category of breastfeeding practice and age in months, 2001 and 2006 Demographic and Health Survey (DHS). (a) DHS 2001. (b) DHS 2006. *Data collected among infants and children <24 months living with their mothers during Demographic and Health Surveys in 2001 and 2006, figure courtesy of United Nations Children's Fund West and Central Africa Regional Office.

desired level of optimal breastfeeding practices in Mali. A high proportion of infants <6 months of age are receiving water in addition to breast milk (61%). There is international evidence that the prevalence of diarrhoea and respiratory infections are higher among young infants who are not exclusively breastfed, compared with those who are exclusively breastfed (32, 33). Therefore, continued improvement in rates of exclusive breastfeeding has a potential for also reducing mortality among infants in Mali.

Summary of findings – breastfeeding

- National policies, training materials, and programme activities address the three key breastfeeding practices, but the national coverage of these programmes is not always reported.
- Substantial improvements in breastfeeding rates were reported in Mali between 1995 and 2006 (DHS), specifically in the timely introduction of breast milk and exclusive breastfeeding to 6 months. About two-

thirds of Malian children continue breastfeeding to 22–23 months of age and these rates have not changed since 1995. Breastfeeding promotion in Mali appears to have varied results depending on the practice promoted, but programme evaluations are insufficient to elucidate which or whether these programmes have had an impact on the reported improvements.

- DHS reports also demonstrate that the majority of infants 0–6 months who are not exclusively breastfed are receiving just water in addition to breast milk. Exclusive breastfeeding rates among infants <6 months could reach nearly 80% in Mali if the use of water was eliminated.
- Several national-level activities that may have contributed to the reported improvements in breastfeeding practices include: (i) the implementation of annual or semi-annual national breastfeeding campaigns; (ii) the formation of a national committee charged with the promotion of exclusive breastfeeding (5); (iii) the adoption of the ILO Convention on Maternity, which supports women's right to maternity leave and time away from work to breastfeed (34); (iv) the passage of a national Code for the Marketing of Breast Milk Substitutes (Code); and (v) the promotion of the Baby Friendly Hospital Initiative (BFHI).
- Five studies, conducted between 2001 and 2008, inquired into local beliefs related to breastfeeding practices that would be useful in developing educational messages. However, because these were small-scale studies, the findings should be evaluated in a more representative population to guide evidence-based programme development.
- Monitoring and evaluation have been conducted for some programmes, but they have not been rigorous enough to evaluate whether specific programme components are being implemented as designed and whether the programme is having the desired impact on improving breastfeeding practices.

Recommendations – breastfeeding

- More rigorous monitoring and evaluation is needed to confirm whether programmes are implemented as designed, and to assess the impact of the programme. For example, as programmes are implemented, the roll-out could be randomized to allow comparison of

IYCF indicators in new programme sites compared with sites where the programme has not yet been implemented.

- The effective programmes should then be expanded.
- Further evaluations of barriers to optimal breastfeeding practices, such as the use of water in the first 6 months of the infant's life, are needed to guide programme development so that improvements in breastfeeding practices can expand to the majority of infants and young children.

Complementary feeding

Although no national dietary analyses are available in Mali, the Food and Agriculture Organization of the United Nations collects data annually on the available national food supply (35). Their findings indicate that the diet in Mali is mainly plant-based, with 63% of available calories coming from rice, millet, sorghum, and maize. These cereals are typically high in phytates that inhibit absorption of some micronutrients such as zinc and iron. The most bioavailable sources of many micronutrients, such as zinc, iron, and vitamin A, are animal sources, and just 26% of available protein comes from animal products in Mali. Further, just 19% of calories come from fat. A lack of adequate dietary fat can reduce the bioavailability of plant-based vitamin A precursors and fats provide concentrated energy to young children who cannot consume large quantities to meet their caloric needs. These data indicate that a nutritionally adequate diet of complementary foods is not readily available to infants and young children.

National policies, strategies, and plans of action

National policies, strategies, and plans of action (5–7, 9, 36) promote two of the four key CF practices: (i) timely introduction of complementary foods at 6 months of age; and (ii) use of foods with high nutrient content, particularly animal source foods and foods high in vitamin A and iron. The two practices that are not addressed are: (i) the gradual increase in appropriate frequency and consistency of complementary

foods; and (ii) responding to the child's hunger cues and assisting him/her to eat.

Formative research

In a recent peer-reviewed study, Ayoya *et al.* (37) demonstrated a step-wise method of developing nutrient-dense recipes based on foods that are already used as complementary foods for children 6–23 months of age. The cost of conducting these analyses was not included to determine whether this methodology would be feasible for programme development in all regions, but it should be feasible to identify alternatives for ingredients that are not available in other regions.

We found several small-scale surveys that evaluated positive and negative beliefs and practices related to complementary feeding (12–14, 21). Some of the more consistent findings were the belief that infants should not be offered solid foods until they can feed themselves at around 8–9 months and a lack of knowledge of which foods have high nutrient contents.

Although these findings are not necessarily representative of the general population, they provide guidance on topics for expanded surveys, and thus for future development of BCC/IEC guidelines.

Training materials, programme protocols, and curricula

Most of the training materials reviewed, including national-level materials, addressed all four practices listed earlier and referenced the ENA approach (38) and/or the Global Strategy for Infant and Young Child Feeding (IYCF) (39) as sources of information. When the ENA or the IYCF Global Strategy was not cited, there were references to a 'minimum packet of activities' (PMA) or 'minimum packet of nutrition activities' (PMN). However, it was difficult to find documentation of which activities were included in the PMA and PMN packets. The documents referring to the PMA/PMN discussed the messages to be addressed, but did not include suggestions on educational messages that might be used to promote these concepts (12).

Programmes

Most of the identified programmes promote complementary feeding, but all four key practices, including appropriate frequency of meals and responsive feeding, are only addressed in the SASDE programme (8) and the SAN+ programme (29), which fully promoted use of the ENA approach. These programmes were implemented in just four of the eight administrative regions. The following SSE documentation, which followed the SASDE, was not yet available, but promotion of ENA was expected to continue as this programme expanded to other regions.

Misola, Simba, UCODAL are locally produced infant cereals, made of combinations of locally produced cereal and legume flours with the goal of providing nutrient dense options for porridges (8, 12, 40). The processing for Misola, and possibly the others, utilizes fermentation techniques to improve the micronutrient bioavailability of the final product. It would be useful to evaluate whether these foods meet international recommendations for the nutrient density of micronutrients, as exemplified earlier by Ayoya *et al.* (37), including an evaluation of the phytate content to confirm the bioavailability of minerals such as zinc and iron (41).

Surveys, monitoring, and evaluation

As discussed in the section on breastfeeding, we found some monitoring and evaluation activities related to certain programmes, but few evaluated the impact of the programme on improving complementary feeding behaviours. One research study evaluated the quality of counselling following IMCI training (42), when the training was conducted in French. The authors reported that the training improved counselling sessions in which both French and the local language were used, but training had no effect when the counselling was solely in the local language. The authors highlighted the need for training that provides essential vocabulary in the local language.

The need for capacity building was highlighted in the PRODESS II monitoring report, which indicated that just 58% of 1037 community health centres (CSComs) were implementing the nutrition aspects

of the minimum packet of activities (PMA) as established by the Ministry of Health(23).

Although several programmes included baseline studies, few evaluated selected indicators at baseline and following the intervention, and the statistical analyses were inadequate to confirm whether the intervention had more of an impact on feeding practices than no-intervention. For example, the Action Contre la Faim (ACF)-IEC programme (13,14) evaluated the impact of IEC messages to promote the introduction of complementary feeding at 6 months of age. The authors reported significant increases from baseline in the use of a separate bowl and the number of meals provided to young children in the intervention sites while the increases in the non-intervention site were not significant. Although the differences between the changes in the intervention site were likely significantly different than the changes in the non-intervention site, this last step of analyses was not presented. Therefore, they could not confirm statistically that the programme had a positive impact on improving complementary feeding practices.

The 1995, 2001, and 2006 DHS collected data from which can be calculated two of the new internationally recommended core indicators of infant and young child feeding practices (43): (i) the per cent of infants consuming complementary foods at 6–9 months of age and (ii) the minimum meal frequency. However, there is insufficient data to calculate the minimum dietary diversity and the consumption of iron-rich and iron-fortified foods. With respect to complementary feeding at 6–9 months of age, it appears that as exclusive breastfeeding increased among infants <6 months of age (Fig. 5), fewer infants commenced complementary foods at 6–9 months of age, particularly nutrient-dense complementary foods. Between 1995 and 2006, the average number of meals consumed per day among children 6–24 months of age dropped from 3.2 to 1.7 and the per cent of children 12–13 months who reportedly consumed iron-rich foods dropped from 41 to 26%. Between 2001 and 2006, the per cent of children 12–13 months who consumed vitamin A-rich foods dropped from 21 to 8%. As with other DHS data, standard errors are not available for appropriate statistical comparisons, but these trends indicate that efforts to improve the

quality of complementary foods among young children have not been successful. It may be that the emphasis on exclusive breastfeeding through national campaigns has had a negative impact on the timely introduction of complementary foods, indicating a need for more balance in educational messages regarding these important feeding practices.

We found 19 studies by PubMed search that incorporated questions related to dietary intakes among infants and young children (37, 44–61). These studies reported on topics such as intakes of certain food groups, the contribution of street foods to the nutritional content of children's diets and the validity of food diversity scores as methods of evaluating intakes (more details in Supporting Information Appendix S1). Several of these studies confirmed the low intake of animal source proteins and dietary fats among low income households. The sample size for most of these studies was not large enough for use in evaluating regional or national intakes among young children for programming needs, but these findings corroborate the findings of the DHS reports, of low intake of nutrient-dense complementary foods. Given that plant foods do not provide highly bioavailable sources of many micronutrients and available data show that children consume few animal source foods, it would be useful to evaluate data from more representative populations to determine whether it is possible for infants and young children to consume adequate quantities of micronutrients (37). In addition, the data collected on dietary diversity may be useful in comparing some local diets with the new internationally recommended core indicators for evaluating infant and young child feeding practices (43).

Summary of findings – complementary feeding

- National policies, training materials, and programmes promote the introduction of nutrient dense complementary foods at 6 months of age, but the promotion of adequate meal frequency and responsive feeding are only promoted in some of the training materials and programme documents.
- National surveys indicate that very few infants and young children consume vitamin A- and iron-rich foods on a daily basis, and optimal complementary

feeding practices appear to have declined during the past decade in which optimal breastfeeding practices improved.

- There are no national surveys evaluating the feasibility of providing nutritionally adequate complementary foods to young children, given household resources. The predominance of nutrient-poor cereals in complementary foods and likely economic barriers to increasing the consumption of animal-source foods indicate that it may be difficult to provide nutritionally adequate diets to young children in poor families.

Recommendations – complementary feeding

- National policies, strategies, and plans of action should be expanded to include all key complementary feeding practices.
- There is a need to confirm that health centre staff is adequately trained and implementing recommended nutrition components of health care packages. Studies are needed to evaluate both nutritional and non-nutritional contributors to the apparent negative trends in complementary feeding practices, such as: (i) the effectiveness of complementary feeding programmes and their individual components; (ii) the affordability and local availability of nutrient-dense complementary foods; (iii) potential target foods for educational messages and possible fortification programmes; (iv) whether target populations can afford, would have access to and would use fortified complementary foods; and (v) livelihood resilience during household shocks that impact child feeding. It might also be necessary to ensure that educational messages are balanced enough to ensure that a focus on exclusive breastfeeding does not have an unintended negative effect on complementary feeding practices.

Prevention and treatment of micronutrient deficiencies

The key micronutrients reviewed are: (i) vitamin A; (ii) zinc, including the use of zinc supplements in treating diarrhoea; (iii) iron, and related causes of anaemia; and (iv) iodine.

Vitamin A

National policies, strategies, and plans of action

The May 2008 National Directives for Vitamin A Supplementation (62) promote semi-annual vitamin A supplementation (VAS) for children 6–59 months and for women postpartum in accordance with international guidelines (63, 64). The Mali Child Survival Strategy Action Plan (36) also addresses the importance of vitamin A for child health. Although one objective of the National Directives for Vitamin A Supplementation is to reach $\geq 80\%$ of women early postpartum with VAS (65), this is not possible through semi-annual national campaigns, which miss all women who give birth in the 3+ months following each campaign. We found little political support for the promotion of VAS through alternative routes, such as regular health checkups following pregnancy.

Formative research/barriers and beliefs

In a peer reviewed study in 1995, Ag Bendeche *et al.* (66) reported that that nearly all children (519 children 6–84 months of age, in Bamako) consumed vitamin A-rich foods at least seven times per week, but the prevalence of clinical signs of vitamin A deficiency were still high. The full article was not available to identify whether the vitamin A-rich foods were plant or animal-based, the quantity of the foods that were consumed, the season of the survey, or whether the fat content of the diet was adequate to enhance the bioavailability of plant-based vitamin A precursors. These reported intakes among children 6–84 months of age are much higher than the reports among children 6–23 months of age for Bamako in the 2001 and 2006 DHS, in which just 12% and 6%, respectively, of these children had consumed a vitamin A-rich food during the previous 24 h.

Training materials, programmes, and programme protocols

The National Nutrition Procedures (PN) (27) recommend providing VAS semi-annually to children 6–59 months and to women up to 8 weeks postpartum. Vitamin A supplements are provided to children 6–59

months and to women early postpartum during the national vaccination days [*Journées Nationales de la Vaccination* (JNV)] or the ‘Intensified week of nutrition activities’ (SIAN) (67). The semi-annual SIAN campaign also reportedly provides education on vitamin A and foods with vitamin A, but the list of foods promoted was not available.

Another programme promoting vitamin A among young children is the augmented Integrated Management of Childhood Illness (IMCI or ‘PCIME’) programme of SASDE and the subsequent SSE programme.

Fortification programmes have also commenced to voluntarily fortify cooking oil with vitamin A (68).

Monitoring, evaluation, and surveys

Between 2003 and 2007 (67) 83–96% of the expected preschooler population was reached by VAS through the SIAN campaigns. The May 2008 SIAN report (67) indicates that although VAS is also supposed to be provided through regular health programmes, monitoring only occurs with respect to the national campaigns or local programmes, such as SASDE. An analysis of the SIAN in the capital of Bamako found that traditional promotion of the event (word of mouth, town criers) was more effective at achieving turnout than modern methods of radio and television (69).

Despite this high reported coverage of VAS nationally through the SIAN campaigns, and high VAS coverage reported in DHS 2006, there is still a high prevalence of vitamin A deficiency among young children. Low plasma retinol was found among 78% of 348 children in seven circles of the Koulikoro region and among 17% of 42 children in the capital of Bamako in 2006 (69). Some possible explanations for these discrepancies include the timing of these surveys with respect to VAS campaigns, low dietary intakes of vitamin A-rich foods, and the drop in retinol concentrations that occur during infection, which was not adjusted for in the analyses. The 2004 SASDE programme evaluation found that health centre staff evaluated the VAS status of just 34% of children 6–59 months who came to the programme’s health centres (8). The difference across the three

circles or zones was vast; ranging from as few as 8% up to 64% of children whose VAS status was evaluated. Specific reasons for these gaps in this required activity were not explained. The report cited a general and severe lack in human resources and staff training in surveyed health centres, with just 11% of staff having received any sort of nutrition training.

The impact of fortifying cooking oil with vitamin A is not yet available, but although it may have an impact on the vitamin A status of women, and thus infants through breast milk, it is unlikely that children will consume enough cooking oil to have a direct impact on their vitamin A status.

As mentioned in the section Complementary feeding, the available food supply is low in animal source foods and fats, indicating that intakes of these foods are also very low, particularly among low income individuals. Animal products contain the most bioavailable food sources of vitamin A and adequate fat intake is necessary to maximize the bioavailability of plant-based vitamin A sources. These factors must be taken into consideration when developing programmes to reduce vitamin A deficiency.

Zinc

National policies, strategies, and plans of action

The use of zinc supplements in the treatment of childhood diarrhoea is specifically addressed in the national BCC strategy (6), but this and the risk of zinc deficiency in the general population is not addressed in the national nutrition policy (9). Based on the prevalence of childhood stunting, the International Zinc Nutrition Consultative Group (IZiNCG) estimated that there is a public health risk of zinc deficiency in Mali (70) and recommended that further evaluations should be conducted to assess population zinc status and, if needed, which interventions might be effective.

Formative research

Four studies were found by PubMed search that evaluated the pilot introduction of zinc in the treatment of diarrhoea (71–74). The authors found that

participants did not necessarily distinguish the treatment of malaria from treatment of diarrhoea, thus, caretakers of children who received zinc as a treatment of diarrhoea did not seek treatment for other symptoms such as fever (presumptive malaria) as often as caregivers of children who did not receive zinc (72, 74). Thus, the inclusion of zinc supplements in diarrhoea treatment could be a health risk in areas where diarrhoea is often accompanied by infections that require additional treatments.

Training materials, programme protocols, and curricula

The national protocols for including zinc in the treatment of diarrhoea are in accordance with international guidelines. However, programme protocols did not yet emphasize the findings of the above-mentioned research indicating that the introduction of zinc into the treatment of diarrhoea might decrease care-seeking for other health risks, such as fever and malaria (72, 74). The table of good food sources of various vitamins and minerals, as found in the Module for Human Nutrition (75) does not list any foods that are specifically high in zinc, such as meat/fish and poultry.

Programmes

Zinc is provided to infants and young children as an adjunct to the treatment of diarrhoea through pilot health centres in the Sikasso and Koulikoro regions (74, 76). Reports of expansion were not yet available. Zinc is reportedly included in the vitamin/mineral premix that is sometimes used for producing Misola, a locally produced complementary food, and in the premix used in voluntary wheat flour fortification. The extent that these products are used for young children has not been evaluated.

Monitoring, evaluation, and surveys

An example of appropriate programme development and implementation is found in the peer-reviewed research articles discussed above (71–74). These studies commenced with evaluations of caregiver beliefs of the causes of diarrhoea, care-seeking behaviours and household decision-making regarding diar-

rhoea treatment, and health worker knowledge and practices related to diarrhoea treatment procedures. Following these evaluations, community meetings were held to explain the importance of zinc in treating diarrhoea. Tailored IEC training and training on correct procedures for treating diarrhoea with zinc were provided to health care workers. After commencement of the programme, monitoring activities assessed whether zinc was being provided appropriately and whether care givers were following counsel received. Problems identified through these monitoring activities were reportedly resolved immediately through follow-up training of health care workers and adjustments to IEC.

Although the authors reported preliminary results that there was a 10% decrease in the use of antibiotics 4 months after zinc supplements were introduced in the treatment of diarrhoea, they did not compare this change with any changes in the non-intervention sites (71). Therefore, this impact could not be confirmed. Following the training of community health workers (CHWs) on the use of zinc in the treatment of diarrhoea, the authors noted that CHW treatment registers indicated that 100% of children received zinc when presenting with diarrhoea and fever, but only 8% received treatment for malaria. As described above, fever could be indicative of malaria or another infection in this region. Therefore, training must emphasize that zinc supplements are not a replacement for the treatment of infections that could be causing an episode of fever. The extent of the scale-up of this programme was not yet confirmed through documentation reviewed.

Iron and anaemia

The prevalence of anaemia is very high in Mali, 89% among children <5 years of age, making this a serious public health priority. However, Mali is also a malaria-endemic region. Thus, the World Health Organization (WHO) recommends caution to ensure that iron supplements (including point-of-use fortification products) are only given to iron deficient children, or iron is provided in small doses distributed over the day in processed complementary foods (76), and that multifactor approaches are used to combat anaemia,

such as the control and prevention of malaria, helminths, and other infections.

National policies, strategies, and plans of action

National policies and strategies (6, 9) recommend the use of insecticide-treated bed nets (ITNs) for the general population, regular deworming of children, and intermittent malaria treatment and daily iron-folic acid supplements for pregnant women as methods of preventing anaemia. Although the possible causes of anaemia are addressed in these policies, the recommended biomarkers are limited to haemoglobin or haematocrit concentrations, which do not allow the differentiation of iron deficiency anaemia from other types of anaemia. Thus, it is not possible to determine whether children have iron deficiency before selecting an intervention.

Formative research

With respect to the prevention of anaemia, we found one small programme-related study on the Mali–Mauritania border (15), which inquired into beliefs regarding the use of mosquito nets. The authors discovered that some participants used them all year, particularly as a ‘marital bedroom’ (15). If children do not have separate bed nets, this would not be a beneficial practice.

Training materials, programme protocols, and curricula

The national nutrition protocols (27) recommend providing iron-folic acid supplements to women during pregnancy and the ENA and minimum packet of activities documents promote the use of iron rich foods, such as animal source foods. The Module for Human Nutrition (75), which is reportedly used in the University of Bamako, School of Medicine, Pharmacology, and Odonto-Stomatology, lists just iron and folic acid as possible micronutrient deficiencies related to anaemia, but it does encourage the promotion of animal foods as sources of iron.

Programmes

Although the guidelines for preventing anaemia were very limited among training materials reviewed, the

programmatic activities that were promoted for the prevention of iron deficiency and anaemia include the provision of ITNs to women and small children, deworming in conjunction with VAS distribution campaigns, intermittent presumptive treatment of malaria for pregnant women, and tracking of general anaemia with periodic haemoglobin assessments through national surveys. Voluntary fortification of wheat flour with iron, zinc, folic acid, and other B vitamins has also commenced (68), but the extent of this voluntary fortification is not yet documented.

The IMCI, is promoted in Mali (9), and these guidelines recommend assessing anaemia among sick infants and young children. The extent that this programme-related component is practiced in Mali was not available in documents identified.

Pregnant women receive an iron-folic acid supplement during prenatal check-ups through the enhanced maternal and neonatal health programme implemented in the four regions where the SASDE was implemented and in regions where the SSE is being expanded nationally (8). In addition, the SAN project in Koulikoro is piloting the introduction of multiple micronutrients during pregnancy in collaboration with the WHO (29).

Monitoring, evaluation, and surveys

The national prevalence of anaemia among young children was 89% as reported in the 2006 DHS (30). This same survey found that, across the eight administrative regions, 30–78% of households have at least one insecticide-treated bed net (ITN), but only 3–42% of children are sleeping under these nets. Reportedly 90% of children received anti-parasites in the first 2007 national nutrition campaign (SIAN) (67). The impact of these anti-parasite treatments on anaemia was not evaluated, but the high prevalence of anaemia indicates a lack of impact of anaemia prevention activities leading up to the 2006 survey. Reasons for this lack of impact must be evaluated to determine where there are gaps in programming, appropriate educational messages or other activities.

Two peer-reviewed studies (78, 79) identified risk factors for anaemia in Mali as: recent infection, lack of bed nets, incomplete vaccinations, stunted growth,

low household living standards, and rural residency. We found no surveys assessing the prevalence of iron deficiency anaemia among preschoolers. A recent survey among 224 school-aged children (80) found that just 30% of children with anaemia also had iron deficiency, as assessed by a combination of haemoglobin $<12.0 \text{ g dL}^{-1}$ and either serum transferrin $>8.30 \text{ mg L}^{-1}$ or serum ferritin $<12 \text{ mg L}^{-1}$. Based on findings in Ivory Coast (81), it is likely that 30% or more of preschoolers with anaemia are also iron deficient, but there is still likely a substantial proportion of young children with anaemia who are not iron deficient. Thus, the international recommendations to use caution in providing iron to anaemic children should be a concern for policy makers and programmers in Mali as a malaria endemic region.

Iodine

National policies, strategies, and plans of action

The prevention of iodine deficiency disorders (IDDs) is addressed in national policies through control of iodine levels in domestic and imported salt and the promotion of the use of iodized salt (9,36). We did not specifically seek the legislation regarding control of iodized salt.

Formative research

The national IDD study (82) found that respondents cared more about the colour of salt than whether it was iodized, and very few understood the importance of iodine in preventing IDD. This lack of understanding was also identified in the ACF-PMN survey (12), in which just 1–6% of women responded correctly to questions regarding the link between iodine and goitre.

Fisch *et al.* (83) assessed an alternative method of iodine prophylaxis in Mali using controlled release of iodine into well water. The authors did not report a comparison between intervention and non-intervention villages, but they reported a significant reduction in the incidence of goitre, from 53 to 29%, and complete disappearance of signs of IDD in the region using the iodized water. We found no references

to subsequent evaluations of this method as an alternative or complement to the use of iodized salt in Mali.

Training materials and programme protocols

We did not seek specific protocols regarding the control of iodized salt because this was beyond the scope of infant and young child-specific guidelines, but the national nutrition protocols (27) and the ENA guidelines (18, 19) promote the use of iodized salt to prevent iodine deficiency and iodized oil is also recommended as a treatment of IDD (27) in CSComs and referral health centres/hospitals (CSRefs). The coverage of these programme components was not evaluated in any reviewed documents.

Monitoring, evaluation, and surveys

In 2005, the national IDD survey conducted among school-aged children found that 68% of children had urinary iodine concentrations below $100 \mu\text{g L}^{-1}$ (82). According to WHO guidelines, a population is considered iodine deficient when more than 50% of the population have urinary iodine concentrations less than $100 \mu\text{g L}^{-1}$ (84). The median urinary iodine concentration for the population of the IDD survey was not reported, but the mean fell between $50\text{--}99.9 \mu\text{g L}^{-1}$, which places the study population in the range for mild iodine deficiency. In a peer-reviewed study, Torheim *et al.* assessed women's iodine status and its determinants in the Kayes region of Mali in 2005 (85) and found that only 6% of the 423 women in the survey had adequate iodine status, as assessed by urinary iodine concentrations $>100 \mu\text{g L}^{-1}$, and just 39% of households used iodized salt. Thus, IDD appears to continue to be a public health concern.

During the IDD survey (82), 26 border control posts were contacted and only three of these reported controlling iodization of imported salt, and very few staff had been trained or had access to the materials necessary to complete necessary iodine tests.

According to DHS data 74 and 79% of women surveyed lived in households in which the salt was adequately iodized in 2001 and 2006, respectively. This relatively high presence of adequately iodized salt seems to contrast the 2005 IDD survey findings of

iodine deficiency among 68% of children. Follow-up surveys are needed to determine whether iodized salt is used frequently enough to prevent iodine deficiency and, if necessary, alternative methods of preventing iodine deficiency should be considered. There were no reports of market or household testing of salt iodine levels beyond the DHS.

Summary of findings – prevention and treatment of micronutrient deficiencies

- National nutrition policies and related programmes promote the prevention of: (i) vitamin A deficiency through VAS to children 6–59 months of age semi-annually, and to women within 6–8 weeks postpartum; (ii) anaemia and/or iron deficiency through promoting the use of ITNs, regular deworming of women and children and iron-folic acid supplements for pregnant and early postpartum women; and (iii) iodine deficiency through the promotion of the use of iodized salt and the regulation of its importation. The prevention of zinc deficiency does not yet have legislative support, but there is national support for the use of zinc supplements in the treatment of diarrhoea.
- A national voluntary programme to fortify oil with vitamin A commenced in November of 2006, and voluntary flour fortification was due to start in 2010. The premix for flour fortification currently includes iron, zinc, folic acid and several B vitamins.
- VAS are distributed through a national week of nutrition activities (SIAN, intended to be semi-annual), an annual national micronutrient day (JNV) and the expanded IMCI programme. According to the 2006 DHS, vitamin A supplements reached 72% of children 6–59 months and 41% of women within eight weeks postpartum. Researchers evaluating a pilot study for the introduction of zinc supplements to treat diarrhoea, found that antibiotic use was decreased, indicating that the zinc supplement filled the perceived need for a ‘medication’ to treat diarrhoea. However, concomitant symptoms of fever were not assessed or treated as often as prior to the introduction of zinc supplements, which could be a risk in this area where fever often accompanies serious infections such as malaria.

- The 2006 national survey found anaemia among 89% of young children, yet less than half of children with access to bed nets were using them as a method of preventing malaria, and thus anaemia. The impact on anaemia of the more recent programme to provide deworming to all young children has not been evaluated.
- The identified prevalence of iron deficiency among anaemic school-aged children indicates that there is likely a substantial proportion of preschoolers with anaemia who do not have iron deficiency.
- Iodization of imported salt is legislated by national decree and national legislation.
- A 2005 national survey found that few of the respondents had heard of iodized salt through mass-media or health providers, and border posts are not properly equipped and/or do not test salt according to protocols. Despite of these problems, nearly 80% of households surveyed nationally in 2006 had adequately iodized salt.

Recommendations – prevention of micronutrient deficiencies

- Continued support is needed to maintain coverage of VAS for young children and to expand VAS to women early postpartum. The reach of VAS to infants at 6 months of age should also be evaluated.
- As efforts continue to expand the use of zinc in diarrhoea treatment, continued vigilance is needed to ensure that concomitant infections are not left untreated.
- Studies are needed to evaluate the prevalence of zinc deficiency in a representative sample of women and young children. Based on these findings, appropriate intervention programmes should be developed to prevent zinc deficiency, if necessary.
- Considering the low prevalence of iron deficiency among anaemic school-aged children and the risk of malaria in Mali, programme activities to treat anaemia should take into consideration the international recommendations to exercise caution in providing iron supplements to possibly non-iron deficient young children.
- The prevalence of iron deficiency should be confirmed among a representative sample of young children along with risk factors so that treatment pro-

grammes can be appropriately targeted using international guidelines for malaria endemic regions. There is also a need to improve the use of available methods of preventing and treating anaemia, such as use of bed nets against malaria, and promote additional methods, such as delayed cord clamping and food-based programmes (targeted fortified foods, point of use fortificants, enhanced processing of available foods).

- Despite the presence of iodized salt in about three-quarters of homes, the prevalence of iodine deficiency is still a public health concern. Studies are needed to confirm whether iodized salt is consumed in adequate quantities to avoid iodine deficiency, and alternative methods of preventing iodine deficiency should be considered.

Other nutritional support – management of malnutrition, prevention of MTCT of HIV, food security, and hygienic practices

Management of malnutrition

Policies, strategies, and plans of action

The management of acute malnutrition is addressed generally in the Nutrition Policies and Norms (PNMN) (9) and the National Strategic Plan for Food and Nutrition (PSNAN) (7) through recommended development of malnutrition rehabilitation centres, community-level management of malnutrition and screening for acute malnutrition through health centres and community outreach. These documents do not recommended cut-offs for screening or diagnosing acute malnutrition.

Formative research

Five peer-reviewed articles and one study provided by key informants addressed malnutrition in Mali (see Supporting Information Appendix S1), but we only had access to one full document (86). This article identified factors associated with malnutrition among children in one region, which could be useful for programmes developed in that region. We found no formative research studies large enough to inform national-level malnutrition programmes. To increase the reach of screening for malnutrition among chil-

dren, the SIAN campaign in June 2007 pilot-tested the integration of screening into the typical campaign activities in two districts of Koulikoro (Nyirandutiye, unpublished observations). During the SIAN activities, 43% of children living in the districts (669 of 1543) 6–59 months were screened for malnutrition. Of those screened, 28% were diagnosed as malnourished [<12.0 cm mid-upper arm muscle circumference (MUAC)], and 57% (106 children) of those diagnosed went to the health centre for treatment. Further studies are needed to increase the outreach and determine why some of the malnourished children did not attend the treatment centres, but this type of outreach could improve detection and subsequent treatment of malnutrition in otherwise unreachable populations.

Training materials, programmes and protocols

The cut-off recommended in training manuals developed in 2007 (87–89) for the evaluation of severe acute malnutrition was 110 mm MUAC, and the height and weight reference tables utilize the old NCHS references. Key informants indicate the WHO Child Growth Standards are currently being integrated into malnutrition programmes.

There are plans to roll out Community Management of Acute Malnutrition nationally along with expansion of the ENA (90). The prolonged intervention of aide and reform programme [*Intervention Prolongée de Secours et de Redressement* (IPSR)] is a long-term intervention programme to ensure food security, which incorporates the management of moderate malnutrition in 22 of the 49 circles in seven districts (91).

Surveys, monitoring and evaluation

In 2006, the prevalence of wasting was very high, 15% of children <5 years had low weight-for-height (<-2 z-score), indicating a serious public health concern in Mali (30). We found the results of one monitoring activity of the IPSR programme, which incorporates the management of malnutrition in seven of Mali's eight regions. The authors found that training was inadequate, tracking indicators were not collected as scheduled, financial support and available food stocks

were adequate for expected needs, but human resources were insufficient, particularly for nutrition-related activities for this programme. This report highlighted the need for capacity building to appropriately carry out the activities required for this programme.

Prevention of MTCT of HIV

Policies, strategies, and plans of action

The National Strategy for the Nutritional Management of Persons Infected and Affected by HIV/AIDS for 2005–2009 (92) recommends exclusive breastfeeding, except when it is affordable, feasible, accessible, sustainable, safe to provide a breast milk substitute. However, as these criteria are rarely possible in the general settings in Mali, this strategy emphasized exclusive breastfeeding over replacement feeding. This concept has been supported in the recent recommendations from the WHO to promote exclusive breastfeeding, in conjunction with antiretroviral therapy, for all infants <6 months of age (93). Considering the high cost of antiretroviral therapy, integration of this WHO recommendation into updated policies and programmes will likely require external financial assistance. The 2005 PNMN also briefly discusses provision of modified animal milk as a substitute for breast milk among infants with HIV+ mothers. However, this practice is no longer recommended internationally (94).

Formative research, training materials, and programmes

No formative research was identified that discussed dietary practices to reduce the risk of MTCT of HIV. The manual for Persons Living with HIV (PVVIH in French) (25) addresses the benefits and risks associated with breast milk substitutes, even when they are considered Acceptable, Feasible, Affordable, Sustainable, and Save (AFASS), and it clarifies the risks associated with providing breast milk substitutes to infants, the need to educate the HIV positive mother on the various risks and benefits, and proper hygiene when preparing breast milk substitutes. At the time of our data collection, UNICEF provided a breast milk

substitute to infants of HIV+ mothers who participated in one of 14 HIV treatment centres in Bamako working to prevent MTCT of HIV (95). UNICEF and WFP also provided additional food aid to women with HIV and their young children through the PRODESS programme (23).

Surveys, monitoring, and evaluation

Monitoring of the Bamako MTCT centres (95) identified that less than 30% of participants received the recommended interventions of nutrition counselling, a culinary class, counselling on infant feeding, and provision of the enriched flour product. It was not clear whether these activities alternated by visit, which may account for so few receiving the services during the visit observed. Most of the mothers interviewed, 91%, reported appreciation of the fortified flour product. This survey also reported that half of the infants surveyed were not breastfeeding, which was likely due to the then current recommendations to provide breast milk substitutes when the situation fit the guidelines of AFASS alternatives.

The DHS found that about half of women 15–45 years were aware that HIV could be transmitted during pregnancy, delivery, or breastfeeding; but just one-fourth were aware that antiretroviral therapy could reduce the risk of transmission. We found no other surveys into feeding patterns among infants or mothers affected by HIV.

Food security

Our analysis of food security was limited to the activities related to IYCN, of which we found very few. A complete review of food security activities in Mali is beyond the scope of this paper. However, because of the importance of the family's food security situation on the health and nutritional status of the child, we also provide a brief overview of more general food security activities occurring in Mali.

Policies, strategies and plans of action

Mali has developed a national food security strategy, and the PNMN (9) and PSNAN (7) also promote food

security activities and recognize the importance of these activities in achieving nutrition goals.

Formative research and studies of barriers and beliefs

We found no formative research articles based in Mali that address food security.

Training materials and programme documents

The IPSR project included food distribution to reduce malnutrition in seven regions identified as high risk for food insecurity (91). Several nutrition-related programmes also promoted agricultural activities, such as home gardens, to improve household food security and/or increase nutrient density of available foods (21, 22, 25, 95–98). The World Food Programme's high price crisis response includes: (i) support for vulnerable rural communities affected by the high price crises; (ii) cash for work in some urban areas; and (iii) food distribution to those affected by cross-border insecurity in the Kidal region (99).

Surveys, monitoring, and evaluation

Early warning tracking systems in Mali assess food insecurity and map regions at risk (97, 100–102) and several programmes monitor the food security situation of the population (98, 102–105). Early warning system evaluations include information on the current use of land, water, fishing, livestock production, and national food banks. The data collected differs across these surveys, so it is difficult to compare the situation across surveys. Available food security surveys indicate that food insecurity is a chronic problem in several regions of Mali, which does not improve across seasons. Key informants working in food security emphasized the need for multi-sector activities to evaluate the relationship between household food accessibility and livelihoods, and use these findings in strengthening livelihoods towards achieving sustainable food security and optimal nutrition.

Hygiene and sanitary food practices

Policies, strategies, and plans of action

As with food security, we inquired into activities to promote proper hygiene that were associated with IYCN. Therefore, we did not inquire into the depth of activities being carried out in the Division within the Ministry of Health that focused on the promotion of good hygiene. General promotion of proper hygiene was included in three of the nutrition policies and strategies (6–8).

Formative research

In a survey conducted for a nutrition programme on the border between Mali and Mauritania, participants reported that soap is too expensive, so it is not purchased (15). Further, the participants reported that due to a lack of food, latrines are rarely needed; therefore there is no need to build them. These were very limited findings that could be used to guide educational messages for this programme, but broader scale research would be needed to guide educational messages in national nutrition programmes.

Training materials and programmes

Among the IYCN documents reviewed, the Training Module for Human Nutrition (74), which is intended for pre-service training of health professionals, provided the most comprehensive guide for safe food preparation and storage techniques, water safety and general hygienic practices. There was little guidance on proper food handling or good hygiene in the general nutrition training manuals and programme documents. The IMCI programme (24), intended for national coverage, promotes general good hygiene, and other small-scale programmes, such as the An Bè Jigi (21, 22), ACF-IEC (14), and the PRODESS Community Nutrition programme (23) also promoted some aspects of proper hygiene. In 2009, Mali, the government and UNICEF promoted the importance of hand washing by gathering about 10 000 school children to break the world record of number of children washing hands at one time (<http://www.unicef.org/wcaro/2009-3705.html>).

Surveys, monitoring, and evaluation

The national DHS surveys collected data on the per cent of households with appropriate methods of disposing of human wastes (in toilets, latrines or by burying the wastes) and the percentage of households with treated water for drinking. The 2006 DHS (30) noted that just 44% of households had either a toilet or a rudimentary latrine to dispose of human wastes and only one-third of households used some sort of treated water for drinking. Based on these results, there is a need to improve hygienic practices and related infrastructure.

Summary of findings – other nutritional support

- The national protocol for the management of malnutrition provides clear guidelines for screening and treatment of acute malnutrition. This document is supported by national nutrition policies and training materials. Facility-based and community-based screening and intervention programmes have been implemented to combat the high prevalence of acute malnutrition among children <5 years of age, but there are still gaps in human and institutional resources to carry out necessary activities.
- The reference standards for screening acute malnutrition are being updated from the NCHS to the new WHO growth standards.
- Although the 2005–2009 National Strategy for the Management of Persons Infected or Affected with HIV was developed prior to the current recommendations to promote exclusive breastfeeding and antiretroviral therapy for infants <6 months of age, this strategy already emphasized that exclusive breastfeeding to 6 months was likely the best feeding choice for most infants of HIV+ women in Mali. This document also promoted food security measures, such as providing supplemental foods, for those affected with HIV.
- Food insecurity has been identified as a chronic problem during both lean and harvest seasons, indicating a need for long-term solutions to the problem.
- The importance of proper hygienic practices was emphasized in national nutrition-related policies, training materials, and programmes, and though

national observance of international hand washing day, but the coverage of relevant training and programme components in nutrition programmes has not been evaluated.

Recommendations – other nutritional support

- Support is needed for human and institutional capacity building to support activities to screen and manage acute malnutrition.
- Screening tools, such as was exemplified in the pilot study that integrated malnutrition screening into the SIAN activities, should be considered to improve screening and thus facilitate the treatment of acute malnutrition.
- National policies, training materials and programme documents for the prevention of MTCT should be updated to include more detail on the recent international feeding and antiretroviral treatment guidelines for infants of HIV+ women.
- Multi-sector support is needed to address the chronic food insecurity problems encountered in Mali, including livelihood strengthening activities that more broadly address this chronic problem.
- Pertinent nutrition-related training materials and programme protocols should include appropriate messages on maintaining a safe environment and preventing food contamination through sanitary food preparation and storage methods.

General findings

- In 2006, the strategic plan to expand the IMCI services (106) identified serious gaps in human resources in Mali. They estimated that there were just seven doctors, 15 nurses, and 5 midwives per 100 000 inhabitants. Further, these gaps were the largest in rural areas. This strategic plan also identified the need to expand the capacity of the available training facilities to fill the gaps in human resources. The authors reported that accessibility of health facilities had recently increased, such that half of the population was living within 5 km of a health centre. However, they reported that usage had not increased as the number of facilities increased.

- During the data collection phase, it was evident that many documents were not readily available. The Centre of Research Studies and Documentation on Child Survival (CREDOS in French) was established as a clearinghouse of information on child survival activities in Mali. However, not all relevant documents are being transmitted to this organization. There is a need to build support for collecting and transmitting relevant nutrition-related activities to avoid loss of pertinent information and duplication of efforts.
- During the meeting to discuss the findings of this situational analysis with the national nutrition counsel, August 2008, the group identified the need for a national system to track and map programme implementation, coverage, supervision, and impact.

Summary

Ratified legislation and available training materials and programmes promote most of the key IYCN practices and related activities. Continued support is needed to ensure that these programmes reach national coverage.

Although one goal of the present analyses was to identify effective programmes, the monitoring and evaluation activities were rarely adequate to achieve this goal. Exclusive breastfeeding rates have increased in the past 10–15 years, but the reasons for this increase were not documented through programme evaluations and the total prevalence is still very low. There is a need to strengthen evidence-based programmes to promote optimal breastfeeding and complementary feeding practices to ensure that these feeding practices continue from birth through at least the critical first 2 years of life. The recently developed national Strategic Plan for BCC addresses many of the gaps in nutrition education messages. As this strategy is implemented, there is a need for rigorous monitoring and evaluation to ensure that this important component of IYCN is implemented effectively.

Vitamin A deficiency, general anaemia, and IDD are addressed through a variety of national or regional programmes, and zinc is being introduced in the treatment of diarrhoea. Support is needed to maintain and expand current programmes nationally

and studies are needed to evaluate why there is low usage of some available programmes and tools. There is also a need to evaluate the prevalence of zinc and iron deficiency in order to develop appropriate interventions, particularly with respect to the risks associated with providing iron supplements to children in malaria-endemic regions who are not iron deficient.

Treatment centres to manage acute malnutrition are established in high-risk regions of Mali, but capacity building and improved monitoring and evaluation are required to ensure these centres are functioning effectively. Application of effective screening tools is also needed to identify and refer malnourished children to these centres.

The food security situation is evaluated regularly, but indicators are not necessarily comparable across surveys to allow tracking. There is a need for multi-sector interventions, including livelihood strengthening activities, to address the chronic problem of food insecurity. Regular meetings among the national nutrition counsel are needed to coordinate these and other nutrition-related activities.

Overall, more rigorous programme monitoring and evaluation are necessary to identify effective programmes, ensure that human and institutional capacities are adequate to carry out these programmes, and to guide appropriate improvements to these programmes, as required. Because few large-scale programmes can be implemented in all desired sites at once, one low-cost method of improving programme evaluations is to randomize the order in which new programmes are implemented. This would allow tracking of IYCF indicators at baseline and following programme implementation in new programme sites compared with sites where the programme has not yet been implemented. Thus, programmes could be improved as they are expanded. In addition, there is a need to improve access to documentation of these activities, such as through government websites or through improvements in the central repository of nutrition-related information.

The foundation has been established, but continued national and international support is needed to improve and expand IYCN activities and thus reach desired goals of improving the nutritional status of infants and young children in Mali.

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Mali summary data

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