EFFECTIVENESS OF NUTRITION INTERVENTIONS IN LOW AND MIDDLE-INCOME COUNTRIES: AN EVIDENCE SUMMARY

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CONTENTS

LIST OF ABBREVIATION

BMGF	Bill and Melinda Gates Foundation
BMI	Body Mass Index
BRAC	Bangladesh Rehabilitation Assistance Committee
CINI	Child in Need Institute
DFID	The Department for International Development
FANTA	Food and Nutrition Technical Assistance Project
FAO	Food and Agriculture Organization of the United Nations
FHI360	Family Health International
FNB	Food and Nutrition Bulletin
GAIN	Global Alliance for Improved Nutrition
GNR	Global Nutrition Report
ICCIDD	International Council for Control of Iodine Deficiency Disorders
IDA	Iron Deficiency Anaemia
IDS	Institute of Development Studies
IFPRI	International Food Policy Research Institute
LANSA	Leveraging Agriculture for Nutrition in South Asia
LMICs	Low and Middle Income Countries
MDGs	Millennium Development Goals
MI	Micronutrient Initiative
MoH	Ministry of Health
RUTF	Ready to Eat Therapeutic Foods
SAM	Severe Acute Malnutrition
SDGs	Sustainable Development Goals
SPRING	The Strengthening Partnerships Results and Innovations in Nutrition Globally Project
SR	Systematic Review
SUN	Scaling Up Nutrition
TN	Transform Nutrition
UNICEF	United Nations Children's Emergency Fund
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight for Height Z scores

1 BACKGROUND

1.1 Description of the problem

Undernutrition remains as an unfinished agenda for the majority of low and middle-income countries (LMICs). The UNICEF defined undernutrition as the outcome of insufficient food intake and repeated infectious diseases. It includes being underweight for one's age, too short for one's age (stunted), dangerously thin for one's height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition) (UNICEF, 1990).

The prevalence of undernutrition cuts across the different segments of populations and the vulnerable groups exposed to different levels of undernutrition include children, adolescent girls, women of reproductive age, elderly and socioeconomically disadvantaged groups. These vulnerable groups from LMICs have higher prevalence of undernutrition that manifest as moderate to severe forms. Globally around 165 million children under the age of five suffer from stunting (low height-for-age), 101 million are underweight (low weight-for-age) and 52 million children are wasted (low weight-for-height). Approximately 90 % of these children live in just 36 countries with the highest prevalence in Southeast Asia and Sub-Saharan Africa (Das et al, 2015). Further, South Asia has the highest prevalence of underweight among adolescent girls of 15-18 years increasing annually by 0.66% in rural areas. On the contrary, the Latin American and the Caribbean countries showed higher regional prevalence of overweight in both rural and urban settings with this prevalence increasing annually by about 0.50% (Jaacks et al, 2015). In urban areas, 38% of countries had both an under- and overweight prevalence ≥10% (Jaacks et al, 2015). Additionally, the prevalence of low BMI (<18·5 kg/m²) in adult women remains higher than 10% in Africa and Asia (Black et al, 2013). The prevalence of single or coexisting micronutrient deficiencies together termed as “hidden hunger” in the populations of LMICs, predominantly of iron, vitamin A and zinc continues as a major public health challenge. The older women are often regarded as neglected part of the communities with high prevalence of undernutrition. About a half of the Bangladeshi older adults had chronic energy deficiency and 62% were at risk of malnutrition (Kabir et al, 2006). Collectively, the above data indicate a double burden of nutritional issues- prevalence of undernutrition and obesity in the vulnerable populations- as a result of nutrition transition.

Risk factors of undernutrition are complex; including national scale determinants to individual specific, and factors which effect at various age and period of life (Scaling up of Nutrition, 2011). The UNICEF conceptual framework on the causes of malnutrition suggests that aetiology of undernutrition is multifactorial, complex and intricate. The framework has classified the causes of undernutrition to three categories as immediate causes (i.e. inadequate dietary intake and infectious diseases), underlying causes (i.e. insufficient access to food, inadequate maternal and child care, poor sanitation hygiene and inadequate health services) and basic causes (i.e. the roles of formal and non-formal institutions, political and ideological superstructure, economic structure and potential resources) (UNICEF, 1998).

Under-or-over-nutrition can have adverse effects throughout the life cycle and has been considered as a leading cause of death, disability, and ill-health (WHO, 2013). For example, maternal overweight and obesity are associated with maternal morbidity, preterm birth, and increased infant mortality. Fetal growth restriction is associated with maternal short stature and underweight and causes 12% of neonatal deaths (Black et al, 2008). Being underweight makes infants and mothers susceptible to infection and longer duration to recover from illness, and with repeated bouts of infectious diseases estimated 3.1 million preventable maternal and child deaths occur annually (Black et al, 2013). Stunting (defined by the WHO as low height-for-age) impair cognitive development, increase susceptibility to infection, and affect school attainment and future productivity with intergenerational effects (Bhutta et al, 2013). Further, deficiencies in iron, iodine, zinc, and vitamins can cause problems such as brain damage, blindness, anaemia, and stunted growth. Undernutrition affects learning abilities, and cause delayed achievement of developmental milestones in children. In turn, such adults fail to reach their full growth potentials influencing their socio-economic productivity resulting in poor economic growth (Hoddinott, 2013).

1.2 Description of the interventions to improve nutritional and health status

The global nutrition scenario has changed significantly ever since the constitution of MDGs. Increasingly, more countries recognise the potentials of good nutrition to strengthen societies and transform the lives of vulnerable populations, including children, women and socio-economically disadvantaged populations. As a result, multitudes of interventions to reduce undernutrition at different stages of lifecycle had been recommended and implemented in various countries, including the LMICs.

Many adverse effects of undernutrition including morbidities and mortalities in vulnerable populations could be prevented through timely nutrition interventions. These nutrition interventions have both preventive and curative purposes, especially in LMICs and scaling up of these valuable interventions have shown to be hugely beneficial to the millions of populations (Bhutta et al, 2013). The Lancet (2013) series on maternal and child health examined these multitudes of interventions that were implemented in 34 countries and ascertained that scaling up of these interventions reduce deaths in children younger than five years by 15% (Bhutta et al, 2013).

The nutrition interventions were categorized to nutrition-specific and nutrition-sensitive interventions (Bhutta et al, 2013).

- Nutrition-specific interventions refer to those programmes and approaches that have direct impact on nutritional outcomes and address the immediate causes of undernutrition (i.e. inadequate food intake, poor feeding and care practices and high burden of infectious diseases). The ten nutrition-specific interventions with evidence for effectiveness of nutrition interventions and delivery strategies identified included supplementation of folic acid, calcium, balanced protein-energy and micronutrients to pregnant women; promoting breast feeding and delivering appropriate complementary feeding to infants, providing vitamin A and zinc supplements to children up to the age of

five; and using proven treatment strategies to manage moderate to severe malnutrition in children.

- Nutrition-sensitive interventions and programmes include programmes that address some of the underlying determinants of nutrition (e.g. poverty, food insecurity, poor health, gender inequity, etc.). Nutrition-sensitive interventions include agriculture, home gardens and homestead production systems, biofortification, social safety nets, conditional and unconditional cash transfers, school feeding programmes, household food distributions, early child development and schooling.

The above interventions could be delivered through a wide variety of platforms providing enough opportunities to scale up these strategies to reach large number of these socioeconomically disadvantaged and vulnerable populations in LMICs. The different platforms include fortification of staple foods to reach large segments of populations; cash transfer programmes to reduce poverty, reduce financial barriers, and to improve population health; community based platforms for nutrition education and promotion aimed to promote behaviour change; community mobilization strategies to promote health care; integrated management of childhood illnesses strategies to improve healthcare practices at health facilities and home; school based delivery platforms to reach children >5 years of age to improve nutritional status through feeding programmes while promoting school enrolment; and child health days to deliver nutrition interventions such as vitamin A supplements, immunizations, insecticide-treated nets and deworming drugs (Bhutta et al, 2013).

Implementation of nutrition-specific interventions may appear to be simple, cost-effective and straight forward to improve the nutritional status of different populations, however, delivery, uptake and utilization of such interventions are extremely complex to achieve the desired outcomes. The implementation of these interventions is often influenced by several factors including behavioural, contextual, social, access and system barriers (Middleton et al, 2012). Some of such programmes made limited impact on the expected outcomes due to complex social environments, poverty and lack of access to quality food items, gender inequalities, social beliefs and lack of opportunities to participate in decision making process.

1.3 Benefits of nutrition interventions

Nutrition interventions are primarily aimed to improve the nutritional status of populations augmenting their dietary intakes to achieve optimal/desirable intakes of various nutrients. Nutrition-specific interventions such as direct supplementation of various nutrients (i.e. balanced protein-energy, calcium, iron, folic acid, vitamin A, zinc, iodine etc.) aims to improve the intakes of these nutrients to prevent nutrient deficiencies in different populations including women and children. The majority of populations living in LMICs have limited access to nutrient dense foods, such interventions are beneficial as they subsist on predominantly cereal-pulse based diets that are insufficient to adequately provide many of these nutrients.

Supplementation of folic acid to women of reproductive age has shown 72% reduction in risk of development of neural tube defects (De-Regil et al, 2010); daily iron supplementation during pregnancy reported 70% reduction in anaemia at term, 67% reduction in iron deficiency anaemia (IDA), and 19% reduction in the incidence of low birthweight (Pena-Rosas, 2012); multiple micronutrient supplementation reported 11–13% reduction in low birthweight and SGA births (Haider and Bhutta, 2012); calcium supplementation during pregnancy reduced the incidence of gestational hypertension by 35%, preeclampsia by 55%, and preterm births by 24% (Hofmeyr et al, 2010); iodised oil supplementation in pregnancy in severe iodine deficient populations showed a 73% reduction in cretinism and a 10–20% increase in developmental scores in children, (Zimmermann, 2012); and balanced energy-protein supplementation during pregnancy increased birthweight by 73g (95% CI 30–117) and reduced risk of SGA by 34%, with more pronounced effects in malnourished women (Imdad and Bhutta, 2012).

In neonates, breast feeding initiation within 24 h of birth was associated with a 44–45% reduction in all-cause and infection-related neonatal mortality (Debes et al, 2013); in children between 6 to 23 months of age consumption of a minimum acceptable diet with dietary diversity reduced the risk of both stunting and underweight (Marriott et al, 2012); vitamin A supplementation reduced all-cause mortality by 24% and diarrhoea-related mortality by 28% in children aged 6–59 months (Imdad et al, 2010); intermittent iron supplementation to children younger than 2 years reduced the risk of anaemia by 49% and iron deficiency by 76% (De-Regil et al, 2012); and preventive zinc supplementation reduced the incidence of diarrhoea by 13% and pneumonia by 19%, with a non-significant 9% reduction in all-cause mortality (Yakoob et al, 2011).

Evidence from studies that compared ready-to-use therapeutic foods (RUTF) with standard care in community based management of severely acutely malnourished (SAM) children showed no effects on reduction mortality; however, children who received RUTF had faster rates of weight gain and had 51% greater likelihood to recover (defined as attaining WHZ ≥ –2) than did those receiving standard care (Lenters et al, 2013). In a landmark randomized control trial in children with uncomplicated SAM that compared standard RUTF with RUTF and additional 7 day course of antibiotics showed a lower mortality rate, faster recovery rate, and higher weight gain in children who received an antibiotic compared with children receiving placebo (Trehan et al, 2013).

Table 1: Summary of evidence for nutrition-specific interventions from 34 highest burden countries from LMICs

Interventions	Findings
Supplementation of folic acid to women of reproductive age	Has shown 72% reduction in risk of development of neural tube defects (De-Regil et al, 2010)
Daily iron supplementation during pregnancy	Reported 70% reduction in anaemia at term, 67% reduction in iron deficiency anaemia (IDA), and 19% reduction in the incidence of low birthweight (Pena-Rosas, 2012)
Multiple micronutrient	Reported 11–13% reduction in low

supplementation	birthweight and SGA births (Haider and Bhutta, 2012)
Calcium supplementation during pregnancy	Reduced the incidence of gestational hypertension by 35%, preeclampsia by 55%, and preterm births by 24% (Hofmeyr et al, 2010)
Iodised oil supplementation in pregnancy in severe iodine deficient populations	Showed a 73% reduction in cretinism and a 10–20% increase in developmental scores in children, (Zimmermann, 2012)
Balanced energy-protein supplementation during pregnancy	Increased birthweight by 73g (95% CI 30–117) and reduced risk of SGA by 34%, with more pronounced effects in malnourished women (Imdad and Bhutta, 2012).
In neonates, breast feeding initiation within 24 h of birth	Was associated with a 44–45% reduction in all-cause and infection-related neonatal mortality (Debes et al, 2013)
In children between 6 to 23 months of age consumption of a minimum acceptable diet with dietary diversity	Reduced the risk of both stunting and underweight (Marriott et al, 2012)
Vitamin A supplementation	Reduced all-cause mortality by 24% and diarrhoea-related mortality by 28% in children aged 6–59 months (Imdad et al, 2010)
Intermittent iron supplementation to children younger than 2 years	Reduced the risk of anaemia by 49% and iron deficiency by 76% (De-Regil et al, 2012)
Preventive zinc supplementation	Reduced the incidence of diarrhoea by 13% and pneumonia by 19%, with a non-significant effects - 9% reduction in all-cause mortality (Yakoob et al, 2011).
Ready-to-use therapeutic foods (RUTF) with standard care in community based management of severely acutely malnourished (SAM) children	Showed no effects on reduction mortality
Children who received RUTF	Had faster rates of weight gain and had 51% greater likelihood to recover (defined as attaining WHZ ≥ –2) than did those receiving standard care (Lenters et al, 2013).
Children with uncomplicated SAM that compared standard RUTF with RUTF and additional 7 day course of antibiotics	Showed a lower mortality rate, faster recovery rate, and higher weight gain in children who received an antibiotic compared with children receiving placebo (Trehan et al, 2013)

Nutrition-specific interventions are short-term strategies and are aimed to combat issues of undernutrition through targeted approach of supplementation of nutrients to the specific groups of populations. The sustainability of such interventions/ programmes is often a great challenge and needs huge investments. A more prudent approach would be to have a

combination of both nutrition-specific and nutrition-sensitive approach in order to improve the dietary intakes of nutrients and thus, nutritional status indirectly.

Nutrition-sensitive programmes aid to accelerate improvements in nutritional status by augmenting household and community environments, protecting the poor from the adverse implications of food security threats and climate change (Ruel et al, 2013). Targeted agricultural programmes can influence nutrition through key mediators including women's social status, empowerment, control over resources, time allocation, and health and nutritional status (World Bank, 2007; Gillespie et al, 2012). The effects of homestead food production systems on intermediary outcomes along the impact pathway, showed positive effects on household production and consumption, maternal and child intake of target foods and micronutrients, and overall dietary diversity (Leroy et al, 2008). Biofortification strategies are found to be successful in improving the dietary intakes of different micronutrients such as vitamin A, iron and zinc, contributing to achieve adequate intakes of these deficient nutrients. The majority of these nutrition-sensitive programmes improve the food availability and food consumption, thus, favouring adequate food intakes, increase dietary diversity to ensure appropriate nutrient intakes in the vulnerable populations. The impact of these interventions are indirectly associated with the nutritional and health status, and hence these interventions may be quantified based on the other secondary inputs such as impact on improving income of the family, access to quality food items and so on. Further, impact may be measured on specific indicators from such secondary outputs.

Table 2: Summary of evidence for nutrition-sensitive interventions

Interventions	Findings
Targeted agricultural programmes	Can influence nutrition through key mediators including women's social status, empowerment, control over resources, time allocation, and health and nutritional status (World Bank, 2007; Gillespie et al, 2012)
Homestead food production systems on intermediary outcomes along the impact pathway	Showed positive effects on household production and consumption, maternal and child intake of target foods and micronutrients, and overall dietary diversity (Leroy et al, 2008).
Biofortification strategies	Found to be successful in improving the dietary intakes of different micronutrients such as vitamin A, iron and zinc, contributing to achieve adequate intakes of these deficient nutrients.

1.4 Rationale

Evidence summaries harvested from existing systematic reviews (SRs) and meta-analyses help to consolidate the available evidence in a specific area to support evidence-based policy formulations and implementation of programmes that might benefit the vulnerable populations, especially in the LMICs. The development of evidence summaries not only support formulation of policies but also these evidence generated could be contextualized country-specific or region specific to improve the health outcomes of the populations. Additionally, such summaries provide insights into the availability/non-availability of the existing evidence in a particular theme or area of research.

Under- and over-nutrition issues in vulnerable populations continue as a major public health challenge that adversely impact nutritional and health status of populations; in its severe forms results in morbidity and mortality. These nutrition issues are preventable with timely interventions and support in a cost-effective way. The Lancet maternal and child health series (2013) showed multiple benefits of scaling up of nutrition-specific and nutrition-sensitive interventions in reducing maternal and child mortality. The evidence from the above series politically and socially motivated the implementation of large scale nutrition programmes or interventions in many developing countries, especially as an attempt to achieve target of MDGs-reducing maternal and infant mortality by 2015.

There are many nutrition interventions implemented globally, especially in developing countries to improve health and nutrition status of the vulnerable and/or socioeconomically disadvantaged populations. The impact of these nutrition interventions have been positive, however, they had inherent challenges at the implementation level that influenced the uptake and delivery (a conceptual framework presented below). Subsequently, in different developing country settings these interventions showed mixed results due to inherent challenges in access, availability, implementation, delivery and uptake by different segments of populations (refer contextualisation section) . Thus, the majority of undernutrition challenges remain as unfinished agenda in LMICs. Additionally, more evidence from research emerged in the last few years regarding potential new interventions and the innovative delivery platforms for implementation of these targeted interventions that might improve the nutrition and health status of socioeconomically disadvantaged populations.

In this scenario, it may be prudent to gather more evidence to critically analyse and identify key characteristics of successful interventions in LMICs and contextualize it to South Asian countries and particularly Bangladesh. Developing country-specific evidence on potential interventions would be of interest to policy makers in LMICs, as policy making decisions are often spontaneous without adequate evidence. Further, the results from such evidence summaries might be a foundation for many developing countries to implement evidence-based country-specific nutrition interventions to improve the health and nutrition status of populations in a most culturally and socially appropriate way. This approach would allow the countries to revisit and strengthen these nutrition interventions to achieve nutrition related (Goal 2) targets of SDG by 2025.

1.5 Research aims and review questions

The aim of this meta-review will be to identify, critically appraise and provide an overview of review-level evidence on the effectiveness of nutritional interventions delivered in LMICs. This will be achieved by addressing the following primary research question:

a. **Primary question**: What review-level evidence exists on the effectiveness (i.e. in terms of achieving the set targets and outcomes) nutrition interventions in LMICs?

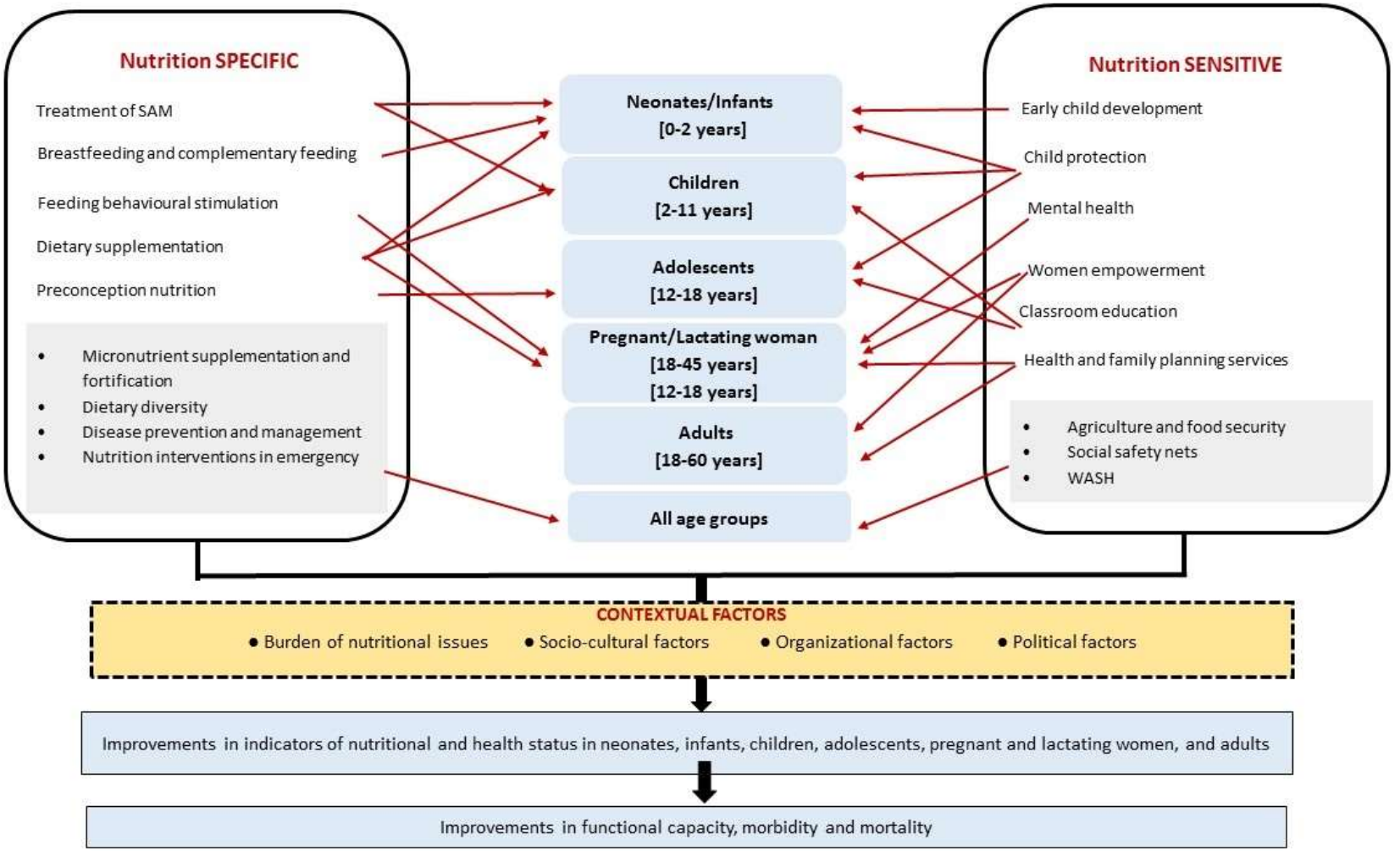
Depending on the nature and extent of the evidence-base on the effectiveness of nutritional programmes in LMIC's it may be possible to provide further review-level evidence to answer the following research questions:

b. **Sub-questions**

1. What types of nutrition interventions aimed at improving nutritional and health status of the general population in LMICs are shown to be effective?
2. What review-level evidence exists on the factors potentially contributing to the success or failure of nutritional interventions in LMICs?
3. Is there review-level evidence of effectiveness of nutrition interventions specific to urban settings in LMICs? If so, what are the key characteristics of successful nutrition intervention programmes delivered in urban settings[1]?

[1] In case sufficient SRs are not found covering urban settings in particular, then the findings will not be drawn for urban context in particular and "Urban settings" will be dropped from the question. The question will focus on LMIC with other possible contexts (e.g. literacy, income level, gender etc.).

Conceptual Framework



2 METHODS

2.1 Advisory group involvement

We have established a multidisciplinary review team and advisory group *(Appendix 1.1)* with significant experience of nutrition programs in South Asia. These members were involved in developing and finalising the protocol. Additionally, we will include two members from DFID as well in the advisory group. We will engage with the advisory group throughout the different stages of the review through different channels of communication such as emails, telephone and skype to get their input and feedback on search terms, screening, data extraction tool, synthesis, final report writing and dissemination of study findings. Depending on the feasibility, we may hold one face to face meeting with the advisory group during the final stages of the review.

2.2 Defining relevant reviews: Inclusion criteria

All located citations will be assessed first on the basis of title and abstract. The full publication of those meeting inclusion criteria *(Appendix 2.1)* will be retrieved and assessed again for inclusion. For systematic review citations to be included on title and abstract, studies must:

Language: be published in English, in order to be completed within the limited time boundary of the project.

Types of Studies:

SRs that have used explicit systematic methods to identify studies- such as have searched at least two electronic databases, included a method to describe how the studies were selected- will be used. Depending on the quality of the reviews, we synthesise primary evidence on the effectiveness of nutrition programs in LMICs and draw conclusions based on findings from individual studies irrespective of the study designs of the included primary studies.

Population: include the general population of low and middle-income countries with a specific focus on vulnerable groups such as children, women and other socio-economically disadvantaged groups. Low and middle income countries will be classified according to the World Bank definition (World Bank, 2016).

Interventions: aim to tackle issue of under-nutrition by improving dietary intake of beneficiaries including both nutrition specific and nutrition sensitive approaches and programmes. The **Comparators** will include all SRs irrespective of they had a comparison group or not.

Outcomes: Will include primary and secondary outcomes that reflect nutritional and health status of the population. A list of potential indicators that reflects primary and secondary outcomes based on a quick eyeballing of the existing reviews is as follows:

Outcome Indicators

Newborns and infants: Low birth weight, pre-term birth, neural tube defects, iodine, vitamin A deficiencies, initiation of breastfeeding in the first hour after delivery, exclusive breastfeeding, timely introduction of complimentary feeding, continued breastfeeding until two years including the IYCF indicators, neurobehavioral, motor development/cognition indicators, neonatal and infant mortality and morbidity.

Older Children: Wasting (weight-for-height <-2 SD), stunting (height-for-age <-2 SD), underweight (weight-for-age <2 SD), anaemia (low haemoglobin status), overweight/ obesity (weight-for-age >2 SD), vitamin A, iodine and zinc deficiencies, inadequate intakes of nutrients below estimated average of nutrients, neurobehavioral, motor development/cognition indicators, under five mortality, morbidity- diarrheal diseases, respiratory tract diseases and immunization of children.

Pregnant women: Anaemia, weight gain, indicators of micronutrient status of iron, zinc, vitamin B12, folic acid, vitamin A and iodine, iron-folic acid and calcium tablet use, adequate intake of nutrients (as indicated by meeting the estimated average nutrient intakes of pregnancy), pre-eclampsia, and eclampsia.

Adults: Chronic energy deficiency (BMI <18.5 Kg/m2), anaemia, iron deficiency anaemia, iron, calcium, zinc, vitamin B12 and folic acid deficiencies (low serum or plasma levels of respective nutrients).

Outcomes

Primary outcomes

- Reduction in nutritional issues such as wasting, stunting, underweight, chronic energy deficiency, micronutrient deficiencies (anaemia, zinc, iodine, iron, vitamin A, vitamin B12, folic acid) and improvement in adequate dietary intakes of nutrients

Secondary outcomes

- Improvements in functional capacity: cognition, capacity to work, work efficiency
- Morbidity: Reduction in disease burden- overweight, obesity, diarrheal diseases, respiratory tract diseases
- Mortality

PICOCS: Participants, Interventions, Comparators, Outcomes, Context (LMICs) and Study design framework formulates the overall scope and criteria for inclusion of reviews in the evidence summary.

2.3 Identifying reviews: Search strategy

We will conduct a comprehensive search both electronically and manually to identify published SRs. We will contact key stakeholder organizations and individuals from the South Asia region including academics and experts in the field of nutrition; policy makers from relevant government departments; and representatives from donor agencies and special

interest groups for any relevant unpublished reviews. During the protocol workshop, the project team and the consultant had extensive discussions on databases to be searched and potential key words to be used for this evidence summary. Thus developed lists of databases and key words are provided in *Appendix 2.2 and 2.3* respectively. This includes specialist databases for SRs such as the Cochrane databases, Joanna Briggs Institute, DFID, and PROSPERO, searches will be conducted on PubMed, PsycINFO, CINAHL, Web of Science, IBSS, and the libraries of the authors' institutions and online resources such as Google. We will use the EPPI reviewer 4 from EPPI-centre, UK to export the citations produced. Duplications will be removed using EPPI reviewer.

Detailed electronic searches will also be conducted in relevant reports, conference proceedings and other unpublished grey literature. A sample of stakeholders from the South Asia region including academics and experts in the field of nutrition; policy makers from relevant government departments and representatives from donor agencies, special interest groups and other relevant organisations will also be contacted for relevant reviews *Appendix 2.6*. We will also use mediums such as mailing lists and blog postings to identify unpublished and grey literature.

Key words will be used to identify reviews along with Boolean operators using 'AND', 'OR' and 'NOT' to unite and filter the search terms. An example of a search strategy is provided in *Appendix 2.3*. We will seek expert advice from EPPI Centre regarding the suitability of the developed search strategy.

2.4 Screening reviews: applying inclusion and exclusion criteria

Two-stage screening process will be adopted to select systematic reviews:

First stage involves screening of all titles and/or abstracts for eligibility and will be done by two researchers (AR, RR). During this screening, all titles and abstracts that seem to be eligible based on the inclusion and exclusion criteria (*Appendix 2.1*) and those in doubt will be included for next step screening and relevant full text articles will be retrieved.

Second stage: The retrieved full text articles will be independently screened by researchers (RR, AR, SM,) against a checklist of inclusion criteria as outline in *Appendix 2.1.* In case of a discrepancy, a senior investigator (DM, KM, SP) will be involved to make a decision.

2.5 Critical appraisal and data extraction

The included SRs will be appraised by the researchers (AR, RR, SM) for quality using the AMSTAR criteria (Shea et al, 2007). Reviews will be assessed on eleven criteria and these criteria summed, where 11 represents a review of the highest quality. Categories of quality will be determined as follows: low (score 0 to 3), medium (score 4 to 7), and high (score 8 to 11). The risk of bias tool is provided in *Appendix 2.4*. Studies judged to be of low quality will be included if they are relevant during data extraction and synthesis stages.

The reviews will be categorised broadly by aspects such as the type of interventions, primary beneficiaries, quality of studies considered, review methods used, outcomes, recommendations, and implications for policy and practice. The data extraction will be

carried out independently by two investigators with a predesigned data extraction tool. The data extraction tool includes details of authors; year of publication; PICOS (population, intervention, comparison, outcomes and study design); recommendations and implications for policy and practice. The data extraction tool will be developed and tested for its suitability and usability. A preliminary draft is appended in *Appendix 2.5*. We will use a separate tool to extract findings that are of relevance to South Asian region.

2.6. Evidence synthesis and reporting

Towards the end of data extraction, the project team will discuss and decide the possible analyses. We will take input from advisory members and the SR consortium. The analysis and reporting strategy will be finalised during this discussions. Broadly, we will use a narrative numerical synthesis approach following the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines (http://www.prisma-statement.org/statement.htm) to produce the summary report. In addition to textual commentary, we will incorporate summary tables on characteristics of included reviews including the geographical area covered and the types and details of nutrition interventions and outcomes. We envisage categorisations of results in terms of region (rural/urban), population subgroups, types and methods of interventions and outcomes. We will explore the possibility of including a summary table of findings of highly relevant primary studies from the SA region. For the purpose of this review, the South Asian region is described as comprising of Afghanistan, Bangladesh, India, Nepal, Myanmar and Pakistan.

In addition to the findings, the summary will include implications for policy and programmatic development at individual country levels and the South Asia region as a whole. We will also make recommendations for future research based on identified evidence gaps on key policy concerns.

The senior investigators (DM, KM, SP) will lead on writing the different sections of the report.

2.7 Quality assurance process

We will adopt different approaches for quality assurance throughout the various stages of the review. In addition to using standardised tools such as AMSTAR and PRISMA guidelines and the application of pre designed inclusion and exclusion criteria, the coding/data extraction will be conducted by pairs of team members working independently and then comparing their decisions to reach consensus. We will also put in place an additional internal quality assurance mechanism whereby each of the stages will be overseen by one the three senior investigators (DM, KM, SP) who will independently evaluate the process and the outputs such as search strategy, list of databases, key words, data extraction sheet, structure of possible summary tables and summarisation process.

The advisory group members and the EPPI-centre will also be consulted and involved in key activities.

2.8 Contextualisation

The majority of the countries in South Asia including Bangladesh, Nepal, Afghanistan, India, Myanmar, and Pakistan have similar nutritional issues and these countries are undergoing nutrition transition. Although there are multiple interventions to address these nutritional and health challenges in afore mentioned countries- the impact of these interventions were less than the anticipated targets. The delivery of interventions had multiple issues:

Policy level- lack of comprehensive interventions to address all forms of nutrition challenges, interventions do not follow evidence-based approaches, and inadequate commitment to the interventions;

Delivery/implementation- implementation of these interventions at lower scale, poor coverage, lack of access, inadequate availability, poor uptake of interventions, ineffective implementation, inadequate awareness of the benefits of interventions both at the service delivery and uptake levels, and lack of sectoral convergence in implementation;

Monitoring and evaluation- poor in built monitoring and evaluation systems, lack of routine surveillance mechanisms, and inadequate mechanisms to re-evaluate and modify the interventions based on the surveillance data.

The above inherent challenges limit the outcomes of these interventions to achieve the set targets in specific time frames. A general list of contextual factors is as follows (more clarity in this may emerge as we move forward with the review process):

- *Burden of nutritional issues:* the type of nutrition issues, prevalence, populations affected, geographical distribution
- *Socio-cultural factors:* Social norms, cultural practices, women's status, education, transport facilities, socio-economic status, poverty, access to quality foods, food security
- *Organizational:* Adequate availability of healthcare services, appropriate service delivery, equity, access to health care services, existing interventions in the countries, organizations involved in the implementation of interventions, effective implementation of interventions, frequent monitoring and evaluation of the implemented interventions, role of health care providers and workers, and convergence of different sectors, departments (agriculture, health women and child development, and tribal development), and organizations to optimize the desired change
- *Political:* Enabling environments for nutrition, political drive and commitment, adequate support systems to enable the desired change

We will contextualise the findings with respect to above mentioned factors specific for SA region, particularly Bangladesh. This will include stating which findings will be relevant in the light of the existing policy and programmatic initiatives in the region (for example: India: Iron and folic acid supplementation, Kangaroo mother care, Early initiation of breast feeding, Vitamin A supplementation, etc.; Bangladesh: Iron and folic acid supplementation; Pakistan:

Iron and folic acid supplementation, use of iodized salt, etc.). The team includes members with significant experience of nutrition programmes in South Asia and while developing the original proposal we have had extensive discussions about the potential implication of this evidence summary to inform policy, practice and future research. In addition, we will seek feedback from the advisory group and the dissemination workshop participants as well as the SR consortium. We will also hold discussions with relevant stakeholders in SA including telephonic interviews with sector experts, regional government officials/advisors, policy-makers, DFID country advisors, to obtain their views and feedback. We will use templates provided by the EPPI-centre to develop the contextualisation document.

2.9 Dissemination

The findings will be useful and of interest to a wide range of regional, national and local and international stakeholders including policy makers, practitioners, academics, donor agencies and nongovernmental organisations in the field of health, nutrition, agriculture, and social policy. The project will be publicised through marketing support teams of the partner organisations right from the very beginning through online and print media platforms. All the organisations have a proven track record in raising awareness of research initiatives through local, national and international media. In addition to the summary and contextualisation document, other project outputs may include lay summaries for specific groups as relevant (e.g., leaflets for frontline workers; summaries in institutional newsletters) as well as for the general media (e.g., press releases; blog postings; columns in newspapers and magazines); at least one peer-reviewed article in a leading journal; and presentations at international and national conferences and other events involving sector discussions including events from DFID/SR consortium. We will hold a one day dissemination workshop in India towards the end of the study to encourage debate and uptake in the region to a larger extent. This will include representatives and key officials from relevant ministries (ministers/secretaries) from SA countries; key academic institutes in the sector; national and international NGOs; donor agencies; DFID country advisors; representatives from the media and special interest groups (*Appendix 2.6*). In addition to presenting the findings, the workshop will include panel discussions and round tables to offer a platform for stakeholders to exchange information and share ideas pertinent to policy, practice and future research and to develop specific action plans.

3 TIMETABLE

Timetable (some review methods do not include these stages in this order)		
Stage of review	**Start date**	**End date**
Preparing the protocol	28-Mar-16	27-Apr-16
Peer review of protocol (allow 2 months)	28-Apr-16	27-Jun-16
Searching for studies	28-Apr-16	19-May-16
Assessing study relevance	13-May-16	27-Jun-16
Extracting data from studies	28-May-16	10-Jun-16
Assessing study quality	11-Jun-16	20-Jun-16
Synthesising studies	21-Jun-16	21-Jul-16
Preparing draft report	31-Jul-16	27-Aug-16
Disseminating draft report (allow 3 months)	28-Aug-16	27-Nov-16
Revising report	27-Sept-16	20-Oct-16
Submission for publication with the EPPI-Centre		28-Oct-16

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APPENDIX 1.1: AUTHORSHIP OF THIS REPORT

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Not applicable

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Conflicts of interest

None declared

APPENDIX 2.1: INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria

1. **Language**: Published in English
2. **Date of publication**: Jan 2000 to June 2016, in order to be completed within the limited time boundary of the project.
3. **Types of SRs**:
   3.1. Searched at least two electronic databases and included a method describing how the studies were included and/or excluded
   3.2. Synthesised primary evidence on the effectiveness of nutrition programs in LMICs and draw conclusions based on findings from individual studies irrespective of the study designs of the included primary studies
4. **Population:** Include the general population with a specific focus on vulnerable groups such as children, women and other socio-economically disadvantaged groups.
5. **Interventions:** SRs which have included at least one of these interventions that aim to tackle issue of under-nutrition by improving dietary intake of beneficiaries including-
   5.1. Nutrition specific
   5.2. Nutrition sensitive

Nutrition specific	• Folic acid supplementation • Iron supplementation • Iron and folic acid supplementation • Multiple micronutrient supplementation • Calcium supplementation • Iodine supplementation • Iodine fortification • Energy and protein supplementation • Delayed cord clamping • Neonatal vitamin K administration • Neonatal vitamin A supplementation • Kangaroo mother care • Promotion of breast feeding and supportive strategies • Promotion of dietary diversity and complementary feeding • Vitamin A supplementation in children • Iron supplementation for infants and children • Multiple micronutrient supplementation in children • Preventive zinc supplementation in children • Prevention and treatment of SAM- facility based & community based management • Fortification of staple foods and specific foods • Cash transfer programs • Community based platforms for nutrition education and promotion • Integrated management of childhood illness • School based delivery platforms • Child health days • Nutrition interventions in humanitarian emergency settings • Lipid based nutrient supplements • Maternal vitamin D supplementation • Omega-3 fatty acid supplementation in pregnancy
Nutrition sensitive	• Agriculture • Home gardens and homestead food production systems • Fortification

	• Social safety nets • Conditional cash transfers • Unconditional transfers • School feeding programs • In- kind household food distribution • Transfer programs in emergencies • Early child development • Food security • Water, sanitation and hygiene

6. **Comparators:** Will include all SRs irrespective of they had a comparison group or not.
7. **Outcomes:** SRs which have included at least one of these outcomes that reflect

   7.1 Primary outcomes
   - Reduction in nutritional issues such as wasting, stunting, underweight, chronic energy deficiency, micronutrient deficiencies (anaemia, zinc, iodine, iron, vitamin A, vitamin B_{12}, folic acid) and improvement in adequate dietary intakes of nutrients

   7.2 Secondary outcomes
   - Improvements in functional capacity: cognition, capacity to work, work efficiency
   - Morbidity: Reduction in disease burden- overweight, obesity, diarrheal diseases, respiratory tract diseases
   - Mortality

8. **Context:** Population from LMICs, these will be classified according to the World Bank definition (World Bank, 2016)

Exclusion Criteria

Studies will be excluded based on the following criteria-

1. **Language**: are not published in English
2. **Date of publication**: not published between Jan 2000 to June 2016
3. **Types of SRs**: not a systematic review. E.g. they have not
   3.1. Searched at least two electronic databases and included a method describing how the studies were included and/or excluded
   3.2. Synthesised primary evidence on the effectiveness of nutrition programs in LMICs and draw conclusions based on findings from individual studies irrespective of the study designs of the included primary studies
4. **Population:** do not focus on the general population with a specific focus on vulnerable groups such as children, women and other socio-economically disadvantaged groups. E.g.
   4.1. Participants with conditions like, Tuberculosis, HIV/AIDS, infectious diseases (malaria, hepatitis and typhoid), communicable diseases (diabetes, CVDs, chronic respiratory diseases, cancer).
5. **Interventions:** SRs which have not included at least one of these interventions that aim to tackle issue of under-nutrition by improving dietary intake of beneficiaries including-(see inclusion criteria)
6. **Outcomes:** SRs which have not included at least one of these outcomes-(see inclusion criteria)

APPENDIX 2.2 LIST OF DATABASES

Databases (14)	**Global (8)** 1. Annual Reviews Biomedical 2. CINAHL 3. Global Health 4. IBSS 5. Medline 6. PsycINFO 7. PUBMED 8. Web of Science	**Regional (6)** 1. African Journals Online (AJOL) 2. Bangladesh Journals Online (BanglaJOL) 3. Indian Citation Index (ICI) 4. LILACS 5. Nepal Journals Online (NepJOL) 6. PakMediNet
SR Databases (6)	1. 3ie 2. Campbell Collaboration Library for SR 3. Cochrane Database of SRs 4. DFID 5. Joanna Briggs Institute 6. PROSPERO	
Digital Library (2)	1. Bioline International 2. WHO Library and Information Networks for Knowledge (WHOLIS)	

APPENDIX 2.3 SEARCH STRATEGY

Depending on the data base, we will use a combination of free text terms and MeSH terms

INTERVENTIONS [Initial search with intervention terms only]

Intervention* OR initiative* OR process* OR program* OR policy OR policies OR effect* OR "delivery mode" OR implication* OR scheme* OR strategy* OR outcome* OR impact OR evaluat* OR delivery OR implement*

AND

Nutrition* OR “fortification” OR “single nutrient fortification” OR "folic acid supplementation" OR "iron supplementation" OR "multiple micronutrient powder" OR "early childhood development" OR “micronutrient supplementation” OR “micronutrient powders” OR “micronutrient sprinklers” OR "calcium supplementation" OR "iodine supplementation" OR "iodine fortification" OR “energy protein supplementation” OR "delayed cord clamping" OR "neonatal vitamin K administration" OR "neonatal vitamin A supplementation" OR "kangaroo mother care" OR “early initiation of breastfeeding” OR "promotion of breastfeeding" OR “responsive feeding” OR "promotion of dietary diversity" OR "complementary feeding" OR "complementation" OR "vitamin A supplementation" OR "multiple micronutrient supplementation" OR "preventive zinc supplementation" OR “SAM” OR "facility based management" OR "community based management” OR "staple foods fortification" OR "home based fortification" OR "specific foods fortification" OR "cash transfer programs" OR "community based platforms” OR “nutrition education” OR “nutrition promotion" OR “IMNCI” OR "integrated management childhood illness" OR "school based programs" OR “LNS” OR "lipid based nutrient supplements" OR “ready-to-eat foods” OR “RUTF” OR “ready-to-eat therapeutic foods” OR “ready-to-eat supplementary foods” OR “RUSF” OR "vitamin D supplementation" OR " Omega-3 fatty acid supplementation" OR "nutrition sensitive" OR "home gardens” OR “home gardening” OR “kitchen garden” OR “vegetable garden” OR “household garden” OR “household gardening” OR “garden based nutrition program” OR “kitchen garden” OR “kitchen gardening” OR “project garden” OR “homestead plot” OR "homestead horticulture and gardening" OR “food garden” OR “food gardening” OR “home based food garden” OR “homestead food production” OR “homestead food production systems" OR "fortification" OR “bio-fortification” OR "social safety nets" OR “family allowance program” OR “child grant” OR “child support grant” OR “microfinance” OR “social transfer” OR “social assistance” OR “cash transfer” OR "conditional cash transfers" OR “monetary incentives” OR "unconditional transfers" OR "in-kind household food distribution" OR " transfer programs emergencies" OR “feeding” OR “school feeding” OR “meals” OR “snacks” OR “breakfast” OR “mid-day meal” OR “mid day meal” OR “feeding services” OR “lunch” OR "school feeding programs" OR “mot or development” OR "food security" OR “food supply” OR “food distribution” OR “food production” OR “food aid” OR “sustainable agriculture” OR "WASH" OR “water sanitation hygiene”

CONTEXT

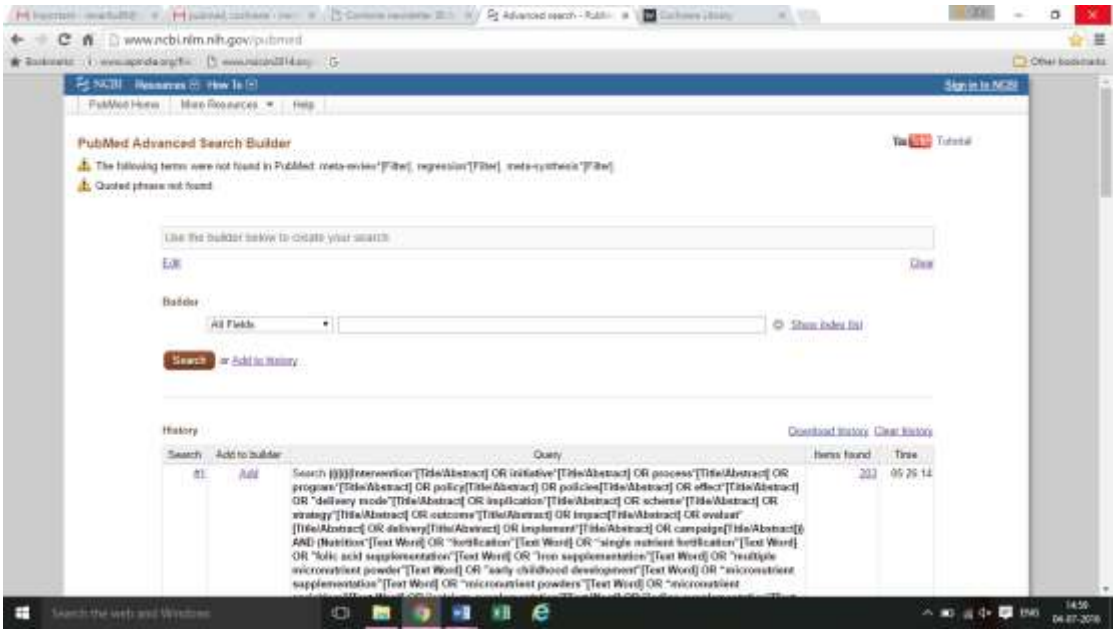
“developing countries” OR “less developed countries” OR “underdeveloped” OR “underserved countries” OR “deprived countries” OR “poor countries” OR “third world countries” OR “transitional countries” OR “low income countries” OR “middle income countries” OR “lower middle income countries” OR “upper middle income countries” OR “low and middle income countries” OR “lesser developed countries” OR “developing nation” OR “developing economies” OR “LMICs” OR “LAMI countries” OR Africa* OR Asia* OR “Caribbean” OR “West Indies” OR “South America” OR “Latin America” OR “Central America” OR “Sub-

Saharan Africa" OR "underprivileged countries" OR "Afghanistan" OR "Albania" OR "Algeria" OR "American Samoa" OR "Angola" OR "Armenia" OR "Armenian" OR "Azerbaijan" OR "Bangladesh" OR "Belarus" OR "Byelarus" OR "Byelorussian" OR "Belorussian" OR "Belorussia" OR "Belize" OR "Benin" OR "Bhutan" OR "Bolivia" OR "Bosnia" OR "Herzegovina" OR "Hercegovina" OR "Botswana" OR "Brazil" OR "Bulgaria" OR "Burkina Faso" OR "Burkina Fasso" OR "Burundi" OR "Urundi" OR "Cabo Verde" OR "Cape Varde" OR "Cambodia" OR "Cameroon" OR "Cameroons" OR "Cameron" OR "Camerons" OR "Central African Republic" OR "Chad" OR "China" OR "Colombia" OR "Comoros" OR "Comoro Islands" OR "Com ores" OR "Congo" OR "Democratic Republic Congo" OR "Costa Rica" OR "Cote" OR "d'Ivoire" OR "Ivory Coast" OR "Cuba" OR "Djibouti" OR "Dominica" OR "Dominican Republic" OR "Ecuador" OR "Egypt" OR "United Arab Republic" OR "El Salvador" OR "Eritrea" OR "Ethiopia" OR "Fiji" OR "Gabon" OR "Gabonese Republic" OR "Gambia" OR "Georgia" OR "Georgia Republic" OR "Georgian Republic" OR "Ghana" OR "Grenada" OR "Guatemala" OR "Guinea" OR "Guinea-Bisau" OR "Guyana" OR "Haiti" OR "Honduras" OR "India" OR "Indonesia" OR "Iran" OR "Islamic Republic" OR "Iraq" OR "Jamaica" OR "Jordan" OR "Kazakhstan" OR "Kazakh" OR "Kenya" OR "Kiribati" OR "Korea" OR "Democratic People's Republic Korea" OR "Kosovo" OR "Kyrgyz Republic" OR "Kyrgyzstan" OR "Kirgizstan" OR "Kirghizia" OR "Krghiz" OR "Lao PDR" OR "Lebanon" OR "Lesotho" OR "Liberia" OR "Libya" OR "Macedonia" OR "Madagascar" OR "Malawi" OR "Malaysia" OR "Maldives" OR "Mali" OR "Marshall Islands" OR "Mauritania" OR "Mauritius" OR "Mexico" OR "Micronesia" OR "Federated States Micronesia" OR "Moldova" OR "Moldovia" OR "Mongolia" OR "Montenegro" OR "Morocco" OR "Mozambique" OR "Myanmar" OR "Myanmar" OR "Burma" OR "Namibia" OR "Nepal" OR "Nicaragua" OR "Niger" OR "Nigeria" OR "Pakistan" OR "Palau" OR "Panama" OR "Papua New Guinea" OR "Paraguay" OR "Peru" OR "Philippines" OR "Romania" OR "Rumania" OR "Roumania" OR "Rwanda" OR "Ruanda" OR "Samoa" OR "Sao Tome" OR "Principe" OR "Senegal" OR "Serbia" OR "Sierra Leone" OR "Solomon Islands" OR "Somalia" OR "South Africa" OR "South Sudan" OR "Sri Lanka" OR "Ceylon" OR "St. Lucia" OR "Saint Lucia" OR "St. Vincent" OR "Saint Vincent" OR "Grenadines" OR Sudan* OR Surinam* OR "Swaziland" OR "Syrian Arab Republic" OR "Syria" OR "Tajikistan" OR "Tadzhikistan" OR "Tadjikistan" OR "Tadzhik" OR "Tanzania" OR "Thailand" OR "Timor-Leste" OR "Timor Leste" OR "Togo" OR "Tonga" OR "Tunisia" OR "Turkey" OR "Turkmenistan" OR "Tuvalu" OR "Uganda" OR "Ukraine" OR "Uzbekistan" OR "Uzkek" OR "Vanuatu" OR "Vietnam" OR "Viet Nam" OR "West Bank" OR "Gaza" OR "Yemen" OR "Zambia" OR "Zimbabwe"

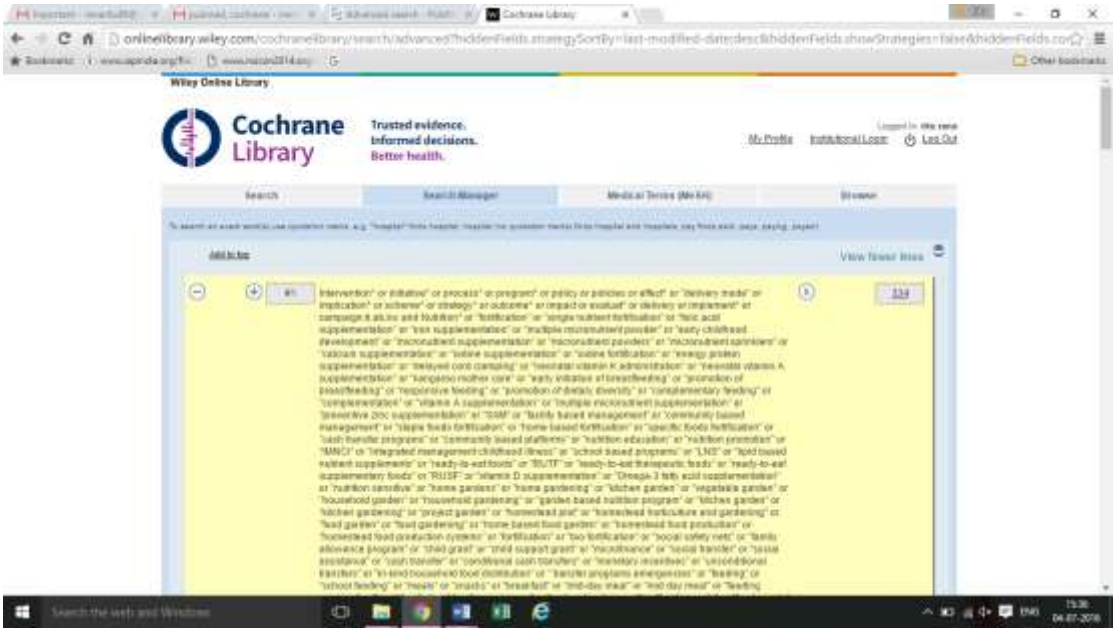
STUDY DESIGN

"systematic review" OR "SLR" OR meta-analysis* OR meta-review* OR meta- regression* OR meta-synthesis* OR "realistic review" OR "descriptive review" OR "research review" OR "thematic review" OR "explanatory review" OR "narrative review" OR "integrative review" OR "mixed method review" OR "qualitative review" OR "quantitative review" OR "research synthesis" OR "evaluation review" OR "evidence mapping" OR "evidence map review" OR "impact review"

EXAMPLE OF SEARCH CONDUCTED ON DATABASE (PUBMED, 203 hits)



EXAMPLE OF SEARCH CONDUCTED ON DATABASE (Cochrane Library, 334 hits)



APPENDIX 2.4: QUALITY ASSESSMENT TOOL

Items

1. **Was an 'a priori' design provided?**

a) 'A priori' design
b) Statement of inclusion criteria
c) PICO/PIPO research question (population, intervention, comparison, prediction, outcome)

2. **Was there duplicate study selection and data extraction?**

a) There should be at least 2 independent data extractors as stated or implied
b) Statement of recognition or awareness of consensus procedure for disagreement
c) Disagreements among extractors resolved properly as stated or implied

3. **Was a comprehensive literature search performed?**

a) At least 2 electronic sources should be searched
b) The report must include years and databases used (e.g. CENTRAL, MEDLINE, EMBASE)
c) Keywords or MESH terms (or both) must be stated AND where feasible the search strategy outline should be provided such that one can trace the filtering process of the included articles
d) In addition to the electronic database (PubMed, ,MEDLINE, EMBASE), all searches should be supplemented by consulting current contents, review, textbooks, specialized registers, or experts in the particular field of study, and by reviewing the references in the studies found.
e) Journals were "hand –searched" or "manual searched" (i.e. identifying highly relevant journals and conducting a manual, page by page search by their entire contents looking for potentially eligible studies)

4. **Was the status of publication (i.e. grey literature) used as an inclusion criterion?**

a) The authors should state that they searched for reports regardless of their publication type
b) He authors should state whether or not they excluded any reports (from the systematic review), based on their publication status, language, etc.
c) "Non -English papers were translated" or readers sufficiently trained in foreign language
d) No language restriction or recognition of non-English articles

5. **Was a list of studies (included or excluded) provided?**

a) Table/ list/ figure of included studies, a reference list does not suffice
b) Table/ list/ figure of excluded studies, either in the article or in a supplement source (i.e. online). (Excluded studies refer to those studies seriously considered on the basis of title and/or abstract, but rejected after reading the body of the text)
c) Author satisfactorily/ sufficiently stated the reason for exclusion of the seriously considered studies
d) Reader was able to retrace the included and excluded studies anywhere in the article bibliography, reference or supplemental source

6. **Were the characteristics of the included studies provided?**

a) In an aggregated form such as a table, data from the original studies should be provided on the participants, intervention and outcomes.
b) Provide the ranges of relevant characteristics in the studies analysed (e.g. age, race, sex, relevant socio economic data, disease status, duration, severity or other diseases should be reported)
c) The information provided appears to be complete and accurate (i.e. there was a tolerable range of subjectivity here. Is the reader left wondering? If so, state the needed information and reasoning)

7. **Was the scientific quality of the included studies assessed and documented?**

a) 'A priori' method of assessment should be provided (e.g. for effectiveness studies if the author(s) chose to include only randomized, double- blind, placebo controlled studies, or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant
b) The scientific quality of the included studies appeared to be meaningful
c) Discussion/ recognition/ awareness of level of evidence
d) Quality of evidence should be rated/ ranked based on the characterized instruments, (Characterized instrument is a created instrument that ranks the level of evidence. e.g. GRADE (Grading of Recommendations Assessment, Development and Evaluation)

8. Was the scientific quality of the included studies used appropriately in formulating conclusions?

a) The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusion of the review
b) The results of the methodological rigor and scientific quality were explicitly stated in formulating recommendations
c) To have conclusions integrated/ drives towards a clinical consensus statement
d) This clinical consensus statement drives towards revision or confirmation of clinical practice guidelines

9. Were the methods used to combine the findings of studies appropriate?

a) Statement of criteria that were used to decide that the studies analysed were similar enough to be pooled?
b) For the pooled results, a test should be done to ensure studies were combinable, to assess their homogeneity (i.e. Chi2 test for homogeneity, I2 statistics)
c) Is there a recognition of heterogeneity of lack of thereof
d) If heterogeneity exists a "random- effects model" should be used or the rationale (i.e. clinical appropriateness) of combining should be taken into consideration (i.e. is it sensible to combine?), or stated explicitly (or both)
e) If homogeneity exists, author should state a rationale or a statistical test

10. Was the likelihood of the publication bias (a.k.a "file drawer" effect) assessed?

a) Recognition of publication bias or file drawer effect
b) An assessment of publication bias should include graphical aids (e.g. funnel plot, other available tests)
c) Statistical tests (e.g. Egger regression test)

11. Was the conflict of interest stated?

a) Statement of sources of support
b) No conflict of interest. This is subjective and may require some deduction or searching
c) An awareness/ statement of support or conflict of interest in the primary inclusion studies

APPENDIX 2.5: DATA EXTRACTION TOOL

Part 1: Full text screening sheet
Part 2: Data extraction sheet for the included full text of systematic reviews

PART 1

1. Full test screening sheet

Screening	**Full text ( )**	
Study ID:	**Data extractor ID:**	Date form completed:
First author:	Year of study:	
Citation:		

1.1 General information

Publication type: Journal article ( ) Conference presentation ( ) Other (specify) _____
Funding source of systematic review:
Potential conflict of interest from funding: Yes ( ) No ( ) unclear ( )
Title:
Aim/objectives:
Setting:
Search Period:

1.2 Systematic review eligibility

Systematic review characterises			**Page/Para/ Figure No.**
Type of study (review authors to add/remove designs based on criteria specified in the protocol)	Is it a systematic review: Yes ( ) No ( ) Unclear ( ) Description:		
Population	Specify population (as mentioned in the systematic review) included: Does the population meet the criteria for inclusion? Yes ( ) No ( ) → Exclude Unclear ( )		
Intervention	Intervention included: Does the intervention meet the criteria for inclusion? Yes ( ) No ( ) → Exclude Unclear ( )		
Outcomes	Tick mark outcomes mentioned in systematic review: <u>Primary outcomes</u> • Reduction in nutritional issues such as wasting, stunting, underweight, chronic energy deficiency, micronutrient deficiencies (anaemia, zinc, iodine, iron, vitamin A, vitamin B_{12},	Other outcomes: List the outcomes as defined in systematic review	

	folic acid) and improvement in adequate dietary intakes of nutrients <u>Secondary outcomes</u> • Improvements in functional capacity: cognition, capacity to work, work efficiency • Morbidity: Reduction in disease burden- overweight, obesity, diarrheal diseases, respiratory tract diseases • Mortality		
	Do the outcome meet the criteria for inclusion	Yes ( ) No ( ) → Exclude Unclear ( )	

1.3 Summary of assessment for inclusion

Include in overview ( )	**Exclude from overview ( )**
Independently assessed, and then compared Yes ( ) No ( )	Differences resolved by discussion Yes ( ) No ( ) Not Applicable ( )
Differences resolved by considering opinion of third investigator Yes ( ) Not applicable ( )	Third investigator ID:
Request further details Yes ( ) No ( )	Contact details of systematic review authors:
Any reply from systematic review authors	
Reason for exclusion/inclusion	

PART 2

2 Data extraction sheet for the included full text of systematic reviews

Study ID:	**Data extractor ID:**	Date form completed:
First author:	Year of study:	
Citation:		

2.1 General information

Publication type: Journal article ( ) Conference presentation ( ) Other (specify) _____
Funding source for the study:
Potential conflict of interest from funding: Yes ( ) No ( ) unclear ( )
Country (ies):
Setting:
Title:
Aim/objectives:
Relevant references from systematic review to be traced: 1. 2. 3.

Inclusion and exclusion criteria of systematic review
Study design:
Participants:
Interventions:
Comparison:
Outcome:
Study design included and number of studies:

2.2 Participants

Participants	Information for each group	Page/Para/ Figure No.
Participants	Specify the population (as mentioned in systematic review) included:	
Number of participants in the review		
Area covered (households, district etc.)		
Rural or urban		
Number of participants considered for analysis of the review		
Age (provide mean or median or range)		

2.3 Intervention (Intervention 1)

Intervention	Nutrition specific intervention	Page/Para/ Figure No.
Description of intervention (as defined in the systematic review)		
Co-intervention if any	Any other intervention apart from nutrition	
Theoretical basis (include key references)	Is theoretical framework for designing the interventions explicitly mentioned? No If yes, whether intervention include single theoretical framework or multiple frameworks are grouped together. Which theories are used? [include with references]	
Did the intervention include strategies to improve nutritional status of children by improving dietary intake and feeding practices	If yes, describe:	
Level at which intervention delivered-	Group/Community	
Place where intervention delivered-	Setting: facility/institution, home, community etc.	
Duration of delivery	Frequency (weekly/monthly/yearly): Duration (weekly/monthly/yearly):	
Medium of delivery		
Subgroups	Describe if any subgroup is considered in the review	
Control/comparison		
Other factors (given along with		

nutrition) which can influence the outcome		

Note: This table will be extended if there are more interventions in the systematic review (e.g. Nutrition sensitive interventions)

2.4 Outcomes

List the outcomes assessed by systematic review

1. _____
2. _____
3. _____
4. _____
5. _____

Outcome 1

Question		**Page/Para/ Figure No.**
Outcome defined		
Number of studies included in systematic review specific to this outcome		
Number of participants specific to this outcome		
At which level the outcome (individual/group) is measured		
Time points measured		
Time points reported		
How is the outcome reported Self or study assessor Cost of source of external support reported?		

Note: This table will be extended if there are more outcomes in the systematic review

2.5 Quantitative analysis
Outcome 1

Results			**Page/Para/ Figure No.**
Whether meta-analysis performed	Yes ( ) No ( )		
If no meta-analysis, reasons for the same			
If meta-analysis performed, effect measures			
Heterogeneity	Identified Not identified	Test used Results	
Homogeneity	Identified Not identified	Test used Results	
GRADE			
ITT (Intention to treat analysis)	Yes ( ) No ( )	Description	
If no meta-analysis, describe the result			
Conclusion			

Note: This table will be extended if analysis is performed for more than one outcome

2.6 Methodological quality

Risk of bias	Tool used		
	Description		

Effectiveness of nutrition interventions if mentioned in the discussion criteria		
Conclusion of systematic review		
Recommendations		

APPENDIX 2.6: LIST OF STAKEHOLDERS

Organization	Office	Contact person	Designation	Address
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