Derivation of nutrient requirements for disaster-affected populations - Sphere Project 2011

Summary of research

Location: Global


What this paper adds: A review and consultation generated a revised list of nutrient requirements for Sphere 2011 based on WHO/FAO RNIs. Requirements for protein, fat, and 19 vitamins and minerals were included; 14 population requirements were revised. The population requirements for seven vitamins, iron, and calcium have increased significantly in Sphere 2011. The requirements for energy and macronutrients remain unchanged but warrant review in the next revision. With the growing use of fortified commodities and products in food assistance operations, future revisions should also include upper limits for population consumption due to risk of excess intake.

The Sphere Handbook defines minimum standards and indicators for assessing humanitarian responses in key lifesaving areas, including food and nutrition. The current version of the Sphere Handbook was published in 2011. Previous versions of the Sphere Handbook contained lists of nutrient requirements to use to assess the adequacy of general food aid rations, a key indicator of many food assistance responses. These lists incorporated the nutrients specified by World Health Organisation (WHO) in 2000, along with some additional nutrients. However, there was a consensus among many of the Sphere consultation participants for the food chapter that, due to advancement in nutritional knowledge and awareness of micronutrient malnutrition, the list should be reviewed and additional nutrients considered for inclusion in the 2011 edition. In addition, the publication of the Food and Agriculture Organisation (FAO)/WHO 2004 Reference Nutrient Intakes (RNIs) necessitated a review of population requirements, as previous Sphere values had been based largely on the WHO safe levels of intake (see footnote 2).

Preparation of a revised list of nutrient requirements for the Sphere 2011 Handbook involved a review of previous recommendations, a consultation on which nutrients should be included, selection of the nutrient list, and calculation of new population requirements based on revised WHO/FAO RNIs. A recently published paper describes the process and justification for the selection of nutrients for inclusion and the methods used to calculate the population nutritional requirements for use in planning and monitoring general rations for humanitarian response.

Review process

A review was undertaken of nutrient requirement references and norms for emergency-affected populations that had been published since 2000. This was supplemented by an on-line consultation process that targeted key informants from WHO, UNICEF, the World Food Programme (WFP), the United Nations High Commissioner for Refugees (UNHCR), Médecins Sans Frontières-Belgium (MSF-B), the Centres for Disease Control and Prevention (CDC), and independent consultants.

Previous versions of Sphere have mainly utilised requirements for emergency-affected populations that were also
developed by WHO but expressed as “safe levels of intake”. Requirements in the latest WHO/FAO report are expressed as RNIs for all nutrients except vitamin A, which are given as “recommended safe intakes”. Requirements for copper were not specified by WHO/FAO in 2004 and were therefore taken from WHO (1996).

Population data from the UN Population Division (UNPD), Population Estimates and Projections Section were used to determine the typical demographic profile for a beneficiary population and allow calculation of mean requirement figures. Regional data from the 2002 tables for less-developed regions were used to calculate the proportion in each age and sex category using the medium variant projection statistic.

The proportions of the different age and sex groups that constituted the reference population were calculated using Excel. Groups were defined so as to correspond with the groups used by WHO/FAO to define nutrient requirements. The requirement figures for each age and sex group were then multiplied by the proportion of the reference population in that group, and the individual group requirements were added together to give the population mean.

UNDP demographic data were only available for whole years. No specific advice was forthcoming from UNDP on how to interpolate figures within whole years. Thus to generate the proportions in the 0-6 months and the 7-11 month categories, the 1-year population was simply divided into 12 and allocated accordingly. It was surprising that for the expression of requirements, FAO/WHO use the categories 0 to 6 and 7 to 11 months, rather than 0 to 5 and 6 to 11 months. However, as the nutrient requirement data were available in these categories, they are used here for calculation.

The prevalence figures for pregnancy (2.4%) and lactation (2.6%) were taken from WHO (2000). To avoid double-counting the 5% of women assumed to be pregnant or lactating, the proportion of women in the 19-50 year age group was reduced by 5%. In reality, in most populations some of the pregnant and lactating women will be less than 19 years old, but no data were available to quantify this proportion and no reduction was performed in the 10 to 18-year age group. It was assumed that all requirements for infants from 0 to 6 months were met by breastmilk, and the requirement for this age group was removed from the calculation of the population nutrient requirements (the nutrients are included in the maternal lactation requirements). To allow calculation in the absence of additional data, it was also assumed that no nutrients were delivered by breastfeeding to older infants.

The nutrient requirement figures for adults are usually expressed by WHO/FAO for the 19-65 year age group. However, for some nutrients this age group is split into two. To calculate the male requirements for vitamin B6 and vitamin D, a weighted average of the requirements for men 19-50 years and 50+ years of age was used. WHO/FAO express the requirement for vitamin K as a range. A single value had to be selected to facilitate calculation of the population requirement, and the midpoint of the requirement range was taken for this purpose.

The requirements in pregnancy were based on two trimesters of the non-pregnant adult female requirement and one trimester of increased requirement.

A low bioavailability for iron of 5% was assumed for all the foods available to the beneficiary population. A weighted average was used for the requirements of adolescents, and it was assumed that all girls were menstruating between 15 and 18 years and none between 10 and 14 years. The requirement for pregnancy was assumed to be the same as for lactation, as no requirement figures for pregnancy are specified by FAO/WHO.

A weighted average was used for the calculation of iodine requirements for adolescents, since WHO/FAO express requirements separately for the age groups from 6 to 12 years and from 13 to 18 years.

A simple average of the trimester requirements for selenium was used for pregnancy, and a simple average of the first and second 6 months postpartum for lactation.
Zinc requirements during pregnancy and lactation were calculated using an assumption of low bioavailability. A simple average of the trimester requirements was used for pregnancy and a simple average of the first and second 6 months postpartum for lactation.

In selecting nutrients for inclusion, it was considered that the 2011 edition should focus attention on the most important nutritional issues affecting the health of emergency-affected populations, to encourage action where problems are identified. Therefore, the number of nutrients to be included should be restricted to those for which there is either a strong international consensus for inclusion or strong evidence for malnutrition associated with deficiency or excess.

**Review outcomes**

The Sphere 2011 process selected all those nutrients previously specified by WHO and other UN agencies in 2000 and 2007 for inclusion. In addition, pantothenic acid, vitamin K, and magnesium had been included in the Sphere 2004 Handbook and were retained in the 2011 edition. However, it was considered that biotin should be removed, as there was a lack of both international consensus and evidence regarding its importance in relevant contexts. This process led to the final selection of protein, fat, and the 19 vitamins and minerals shown in Table 1.

There has been a tendency over time to include an increasing number of nutrients in normative documents (Table 1). This may reflect a growing awareness of the importance of nutrition, an increasing knowledge base, and the availability of tools or food assistance vehicles by which nutrients can be delivered to populations. The Sphere Project has also tended to specify a larger number of nutrients than WHO or other UN agencies.

The calculated population requirements for use in the initial stages of an emergency are presented in Table 2 and compared with those used in Sphere 2004. The requirements for vitamin A, vitamin B1, vitamin B3, vitamin B12, folate, vitamin C, vitamin D, and iron have all increased, with the requirements for vitamin B12 and folate increasing by more than 100% of the 2004 values. In contrast, the requirements for vitamin B2 and iodine have slightly decreased. Vitamin B6, copper, and calcium are additions that were not included in the 2004 handbook. However, a safe level of intake was given for calcium by WHO in 2000; the Sphere 2011 requirement is approximately double this value.

The work on developing recommendations for micronutrient requirements for Sphere 2011 occurred in the context of a number of related or complementary initiatives. These included the introduction of nutritional quality reporting within the WFP International Food Aid Information System (INTERFAIS), based on selected micronutrient content. The nutrient recommendations adopted by Sphere 2011 were designed to take into account the need to try and ensure coherence with these different initiatives, while maintaining Sphere’s role as an independent standard-setting initiative.

Whereas the 2011 Sphere revision led to the revision of initial population requirements for 14 vitamins and minerals, the requirements for energy and macronutrients remained unchanged. It is anticipated that future revisions of the Sphere Handbook may involve an additional review of energy and macronutrient requirements.

The changes in the calculated population requirements imply some challenges for the design and delivery of food assistance. The population requirements for seven vitamins, iron, and calcium have increased significantly in Sphere 2011, due largely to the 2004 RNI values published by WHO/FAO. Further work is required to examine how these revised requirements should be taken into account in the design of food assistance packages, food products and fortification levels for staples. Of note, WFP has recently specified new fortification levels for blended foods. Proposals for new fortification levels for US PL480 blended foods have also been published. The potential role for special nutritional products, such as lipid nutrient supplements, in achieving nutritional adequacy for subgroups of general ration recipients has also been attracting increasing attention. The revision process for Sphere 2011 acknowledged this body of ongoing work, and future editions should review the evidence base at the time and its implications for programme guidance and indicators.
With the growing use of fortified commodities and products in food assistance operations, there is an increasing risk of excessive consumption of micronutrients above the upper intake levels. It may therefore be prudent for future revisions of the Sphere Handbook to include upper limits for population consumption as well as minimum levels of intake. Finally, certain nutrients were omitted from inclusion in the Sphere 2011 Handbook, based on current evidence and international precedent. This is of course subject to change as new evidence is generated, and the basis for inclusion or exclusion of nutrients should also be reviewed in future revisions to the Sphere Handbook.


2The first version of the Sphere Handbook was published in 1998, with subsequent versions released in 2000 and 2004. The most recent revision of the Sphere minimum standards was initiated in 2009/10. Available at: http://www.sphereproject.org/handbook/


4In 2000, the WHO first published population safe level of intakes for energy, macronutrients and a range of vitamin and minerals for emergency-affected populations. These values were designed to be used for planning assistance for food aid-dependent populations and were based on assumptions about the demographic profile, health, weight, and activity level of the beneficiary population and the ambient temperature.

5The revision process for the Food chapter (Minimum standards for food security and nutrition) involved a wide consultation process with humanitarian actors and those directly affected by disasters involving more than 350 people from over 20 countries including representatives of international and local NGOs, community-based organizations, faith-based organizations, national and local government ministries, academic institutions, UN agencies and beneficiaries directly.


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