Slide 1  Technical Seminar – Anaemia, Nutritional Status, and Vitamin A Supplementation

In this technical seminar on malnutrition, I will discuss the clinical assessment and management of anaemia and the rationale for assessment of nutritional status. I will also review the recommendations for vitamin A supplementation, both in illness and in health.

Slide 2  Anaemia — Generic Guidelines

Children with severe anaemia are classified primarily on the basis of severe palmar pallor, while children with moderate anaemia — anaemia as addressed in the IMCI guidelines — are classified on the basis of some palmar pallor.

The decision to use palmar pallor in the assessment of anaemia is based on the difficulty in measuring hematocrits or hemoglobin levels at first-level facilities. Let me explain. The clinical signs for the detection of severe anaemia requiring urgent referral to hospital should be as sensitive and specific as possible because of the mortality from severe anaemia. The technical basis for this decision will be discussed in the subsequent slides.

On the other hand, moderate anaemia requiring iron treatment requires less sensitive and specific signs. However, it is acceptable for the clinical detection of anaemia to be less specific than severe anaemia, because overtreatment with iron is not expensive and is usually not harmful, and subclinical iron deficiency exists in many populations. A lower sensitivity for detection of anaemia is also acceptable since the major causes of anaemia are iron deficiency and malaria.

Many children with moderate anaemia not detected by palmar pallor will receive nutritional counseling, which will improve their iron intake. In areas where malaria is common, children with anaemia will eventually recover even with no iron supplementation, although more slowly (1). The choice of using palmar pallor was based on sensitivity and specificity analysis. It is also possible to use conjunctival pallor to detect
anaemia, however, in places where trachoma conjunctivitis is common, the sign of pallor is **obscured by conjunctival hyperemia** (2). Furthermore, the subjective examination of the palms is not traumatic to the child, while examination of the conjunctiva almost always results in a crying child.

**Slide 3  Anaemia — Treatment**

Children with **severe anaemia** should receive urgent referral to the hospital for a *transfusion* or for management of potential cardiopulmonary insufficiency that can be life saving (3). Children with **cardiopulmonary decompensation** are detected by other severe signs such as lethargy, difficulty to arouse and or chest wall indrawing.

Children with **some palmar pallor** are treated with oral iron for **two months**, with the child being seen every 14 days at which time iron tablets are provided. If there is no improvement in pallor after two months, the child is referred to hospital for further assessment.

**Iron deficiency is the most common cause of anaemia** and occurs in many developing countries where the staple diet does not include meat. This is **worsened by hookworm and or whipworm** infestations, which cause blood loss. Generally, hookworm and whipworm are not problems in children under the age of 2. **Mebendazole** can be used for treatment in children with anaemia who are older than this and where hookworm or whipworm is a significant problem (4).

**Malaria also causes a chronic anaemia** related to persistent parasitemia or severe anaemia related to hemolysis. This anaemia results in significant mortality, which can be reduced by effective *antimalarial treatment or transfusion*. Recently, **iron supplementation** has been shown to promote hematological recovery after attack of acute malaria (1).

If malaria risk is high, patients should be treated with an *antimalarial* (5). In areas where the first line of treatment is sulfadoxine pyrimethamine, and the only iron preparation is one with iron and folate, the **folate will counteract the effect of**
pyrimethamine and should not be given (1). Iron tablets or syrup without folate should be given instead.

**Slide 4  Severe Anaemia — Clinical Signs for Detection**

Studies in Gambia, Bangladesh, Kenya and Uganda compared the use of severe palmar pallor to severe conjunctival pallor alone. Results of these studies (6, 7, 8) showed that the sensitivity of severe palmar pallor is similar to or better than conjunctival pallor, and in all studies, the specificity is about the same as that of conjunctival pallor.

In the studies overall, the performance of severe palmar pallor was better than the combination of two signs — palmar and conjunctival pallor — which decreased sensitivity. Allowing either sign — palmar or conjunctival pallor — resulted in significant loss of specificity and hence, overreferral.

In the Bangladesh study (8), while the sensitivity of severe palmar pallor was low, the addition of any other IMCI referral classification improved the sensitivity to 100%. In the Uganda outpatient study, this addition increased sensitivity from 21% to 68% (8). Thus, while in some settings severe pallor may be missed, the addition of any IMCI referral classification detects most children with severe anaemia who need to be referred.

**Slide 5  Moderate Anaemia — Clinical Signs for Detection**

The assessment of moderate anaemia is more difficult. Studies from Kenya, Uganda and Bangladesh (8) illustrate the sensitivities and specificities for different methods of detection of moderate anaemia.

In a study from Siaya, Kenya, data showed that nailbed and tongue pallor are less sensitive for the detection of severe to moderate anaemia in children aged 2 months to 5 years and that the sensitivities and specificities for conjunctival and palmar pallor are about equivalent.
In Uganda and in Bangladesh, the sensitivity and specificity for detection of mild to moderate anaemia defined as a hematocrit of 15-32% in Uganda or 5-10g/dl hemoglobin in Bangladesh was equivalent for conjunctival and palmar pallor. The differences in sensitivity and specificity may be related to skin pigmentation and the relative frequencies of recognition, and the fact that this classification also examined mild to moderate anaemia. However, when only moderate anaemia was classified — hematocrit 15-23% in Uganda or hemoglobin 5-7g/dl in Bangladesh — the sensitivity in Uganda for conjunctival pallor increased to 71% and for palmar pallor to 69% compared to 74% for conjunctival pallor in Bangladesh and 65% in palmar pallor. Thus, for the accurate recognition of moderate anaemia, some palmar pallor is a reasonable sign. It fairs as well as conjunctival pallor, but has the distinct advantage of simplicity, and is less traumatic to the child. And in areas where there is conjunctivitis or trachoma, there would be less person-to-person transmissions of eye pathogens.

Slide 6  Malnutrition — Nutritional Status

After being assessed for the presence of danger signs and the four main symptoms — cough or difficult breathing, diarrhea, fever and ear problems — all children should be assessed for their nutritional status.

In developing countries, repeated infection and suboptimal food intake result in chronic malnutrition that begins in infancy and usually develops in the first 2 years of life resulting in stunting. In these children, while the weight for age may be low, weight for height is appropriate because the process is chronic. Children classified as very low weight for age have moderate malnutrition and can be managed at home rather than in a hospital. A careful assessment of feeding could identify feeding problems that may be remedied by nutritional counseling.

In contrast, conditions such as severe pneumonia, persistent diarrhea or measles could cause a child who may have been marginally nourished prior to the acute illness, to develop an acute decompensation resulting in marasmus or oedematous malnutrition, which require urgent referral. The hallmark for
-marasmus is visible severe wasting while the hallmark for oedematous malnutrition is oedema of both feet.

**Visible severe wasting is detected** by examining a child in the upright position and taking all the clothes off. In this position, with the legs hanging down, it can be seen that there is very little or no fat and muscle in the buttocks and in the upper thighs giving a “baggy pants” appearance, with loss of gluteal fat or muscle mass and anteriorly causing creases in the upper parts of the thighs. Examination under the armpits reveals loss of axillary fat under both arms and eventually loss of fat in the cheek pads.

**Oedema is detected** by pressing on the middle to latter third of the distal anterior surface of the foot on both sides for a count of five seconds. This is usually the area where oedema is first detected. At later stages, oedema is detected over the tibia, and when generalized over the arms, the skin of the abdomen, and the back and back of head if the child is lying down.

**Slide 7 Malnutrition — Severe Malnutrition**

A study in Kenya (9) illustrates the rationale using visible severe wasting or oedema as simple signs to classify severe malnutrition.

In a study at Siaya District Hospital in Kenya (9), 1,202 children under 5 years old admitted to the hospital were examined for the presence of visible severe wasting and oedema. Their height and weight were also measured. The child’s condition at the time of discharge was noted.

The classic indicator used by experts to diagnose marasmus is a weight for height (WFH) Z-score of less than -3, and this was the best indicator of mortality (10). Children with very low WFH were 3.9 times as likely to die than children without this finding. Similarly, visible severe wasting and oedema had an almost four-fold and three-fold increase of death compared to those who did not have these findings.

Because length boards are generally not available in most developing countries and weight-for-height charts are not
used correctly or commonly, the two signs of visible severe wasting and oedema were chosen. This identified most of the severely malnourished children in the study in whom death occurred. Very few children (19) had a weight for height Z-score < -3 without oedema or visible severe wasting. In contrast, weight for age of < -4.4 was not useful at all and so was excluded from the assessment of severe malnutrition (9).

**Slide 8  Malnutrition — Very Low Weight**

Stunting generally begins in infancy and develops in the first 2 years of life (11). The IMCI guidelines recommend a feeding assessment and nutrition counseling for all children less than 2 years. Low weight for age (Z-score less than -2) is often an indication of current undernutrition among these children. A feeding assessment and nutrition counseling are preventive measures and the case management intervention for children with low WFA can potentially reverse stunting.

But among children older than 2 years, low WFA generally reflects stunting due to past undernutrition. These children should receive feeding assessment and counseling only if they have very low weight and a one-month follow-up visit is scheduled. For children older than 2 years, stunting is not likely to be reversible and nutritional counseling may be seen primarily as a clinical intervention for children with wasting (11).

For these reasons, the choice of a weight for age as a screening indicator has been examined separately for both age groups.

**Slide 9  Malnutrition — Weight for Age**

Weight for height assessments are the most accurate indicators for malnutrition. However, as weight for height is not routinely performed, a weight for age Z-score can be viewed as a proxy estimate for the weight for height.

A threshold of < -3 Z-score of WFA was chosen because the prevalence of children meeting these criteria is between 8-9% of the population in Kenya. The positive predictive values are between 45% and 72% in the older and younger age groups respectively. While a -2 Z-score of WFA would function better as a cutoff and have a higher sensitivity, this would mean that between 24-27% of the population of children being seen in the clinic would be called back for a one-month follow up. To avoid such large numbers of children needing follow up, a Z-score of -3 was chosen as the cut-off point. The complexity of this analysis is illustrated in the next slide.

**Slide 10  Nutritional Counseling — Very Low WFA (<-3 Z-score)**

This slide illustrates the recommendation for nutritional counseling and follow-up visits using a WFA Z-score of <-3.

In the Siaya, Kenya study, a total of 1,785 infants and children were seen. Of these, 1,274 were under 24 months of age and 108 had a WFA Z-score of <-3. There were 511 children (29%) aged 24-29 months, of whom 43 (8%) had a WFA Z-score <-3. The total number of children who would receive a feeding assessment and counseling would thus be 1,317 — and 97% of these receive it because they are younger than 24 months, as specified in the IMCI guidelines as a preventive measure. The total number of children who would receive follow up for WFA Z <-3 would be 151. Of this number, 28% were 24-25 months and 72% were younger than 24 months.

Thus, 1,317 — 74% — infants and children would require nutritional counseling and 151 — 9% — would need follow up.

To change the WFA Z-score to <-2 has dramatic implications. I’ll demonstrate what I mean in the next slide.
**Slide 11  Nutritional Counseling — Very Low WFA (<-2 Z-score)**

These numbers illustrate the affect of changing the WFA Z-score from <-3 to <-2.

You will notice that 1,384 children, or 78%, would be counseled on nutritional status — only slightly more than the 1,317 in the previous slide using a cutoff of <-3 Z. **However, 439 children — almost 25% —would be called for follow up, compared to 151, or 8%, using a cutoff of <-3 Z.**

Thus, **the net effect is very little increase in nutritional counseling but a major increase in the number of children called back for follow-up assessment and counseling.** Calculations similar to these should be made before deciding on a cut-off that is appropriate for each country. The cut-off will depend on the age distribution of children being seen and the proportion of children who are low weight for age in different age groups.

**Slide 12  Malnutrition — Other Measures**

The goal of WFA screening in the IMCI algorithm — particularly for children older than 2 years — is used to identify a subgroup of children whose weight is at the low end of the distribution, especially from a recent illness, and who are therefore more likely to be at greatest risk for a poor outcome. As was illustrated in the last two slides, using a cutoff of WFA < -3 is to decrease the burden of patients coming back to see the health worker. **For population-based assessments,** the conventional threshold WFA Z-score of <-2 is a useful indicator **for comparison among different areas and over time** (12), but this definition is **not useful for patient-based decisions.**

Another indicator to consider is the **mid upper arm circumference (MUAC).** This, however, varies with the age of a child and **does not identify the same children as malnourished compared to weight for height** — the gold standard (13). Furthermore, despite being simple, the MUAC may be prone to errors, since even half a centimeter error in
measurement will make a big difference in classification. **The MUAC is useful for screening in emergency situations** however, it is not recommended for use in the primary health care setting where weight and age can be used very easily.

**Slide 13  Growth Monitoring — Limitations**

Growth monitoring consists of regular weighing of children and plotting the weights on a growth curve, with the advantage being that two or more measurements over a period of time can provide valuable information about a child’s current growth. Thus, it is a potentially powerful tool.

However, there is **no consensus in the literature on the definition of growth faltering**. There are definitions such as weight loss between two monthly measurements, or three monthly measurements with no gain, or weight dropping from one centile line to the next (falling off the curve) which have been used, but there is no common consensus.

Furthermore, studies in India have demonstrated **no effect of growth monitoring on children’s nutritional status** (14), and others have suggested that health workers have difficulty recognizing growth faltering, Even when they do recognize it, appropriate interventions are unlikely (15). Once again, growth monitoring has been used in epidemiologic studies, but its recent application in the field has met with limited if any success in changing nutritional status of children (16).

**Slide 14  IMCI Guidelines - Nutritional Counseling**

The strategy of **intensive nutritional counseling and follow up for children who are low weight for age** has been studied in Brazil and been shown to be effective.

A study of 108 children, as described in this slide, shows the results of changes in weight for age Z-scores after being seen by untrained health workers and after nutritional assessment by health workers trained in the IMCI guidelines.
The zero point represents the initial weight for age value, eight days after consultation. Children not receiving specific feeding counseling did not gain weight adequately and kept losing weight as shown by negative Z-score values. On the contrary, children who received nutritional counseling by trained IMCI health workers gained significantly more weight and were above their centiles at the time of initial consultation.

\textit{Slide 15 Nutritional Status of Population — Setting WFA Z-scores}

The threshold recommended for defining very low weight is WFA Z-score <-3, however a specific threshold can be set by each country. To do this, current anthropometric data is needed that can balance the conflicting needs of using very low weight for age as an indicator of malnutrition and the demand on health facilities in terms of the number of children needing nutritional assessment and counseling. Using the WHO global database on child growth, the worldwide distribution of protein energy malnutrition was studied (12). This slide will help determine the nutritional status of a population and classify the nutritional indicators as low, moderate, high or very high prevalence.

Malnutrition was described based on the quartile distribution observed in 79 countries surveyed. Prevalences for weight for age (WFA) or height for age (HFA) or weight for height (WFH) were calculated. Countries where the population of children under 5 with portions of children with Z-scores <-2 according to the various criteria were classified as low, moderate, high or very high for WFA and HFA. For WFH, the low and moderate were combined to give one classification < 4. Thus, for WFH, there are three classifications instead of four. These figures should be used by countries to determine the strategies utilized for assessment of the nutritional status of the country.

Most developing countries in Latin America have low or moderate prevalence of underweight children, while most countries in Asia have high or very high prevalence. In Africa however, both moderate and high prevalence are found.
The differences between geographical areas as regards stunting and wasting resemble the situation for distribution for underweight: high prevalence in Asia, low prevalence in Latin America and a combination of both in Africa.

Slide 16  Nutritional Status of Population — Setting WFA Z-scores (continued)

The most favorable situation, a low/moderate prevalence of stunting and a low prevalence of wasting, is commonly found in countries in Latin America while the opposite, high/very high prevalence of stunting and wasting, is commonly found in countries in Asia.

A combination of high/very high prevalence of wasting and a low/moderate prevalence of stunting — indicating a predominance of acute malnutrition — is quite common in Africa. The opposite pattern — high/very high prevalence of stunting combined with a low prevalence of wasting, which suggests a predominance of chronic undernutrition — occurs in some countries in Latin America such as Bolivia, Peru, and Guatemala, in some countries in Africa such as Egypt and Uganda, and in the largest country in Asia, China.

High stunting rates mean that for children over the age of 2 years, the false/positive rates for malnutrition will be especially high, leading to a large number of children being treated for a condition which may not improve with nutritional counseling. It is important to understand the intricacies of classification of nutritional status before a Z-score can be chosen that will identify the correct number of children, yet at the same time not overwhelm the system.

Slide 17  Vitamin A — For Curative Purposes

Vitamin A can be given to children for curative as well as preventive purposes (17). All children with corneal xerophthalmia, measles and children with severe malnutrition need to be treated.
**Corneal xerophthalmia** is a medical emergency and treatment should be given immediately. These children should also be given a topical application of an antibiotic such as tetracycline to treat and prevent secondary bacterial infection of the eye.

All children with **measles** should have the eyes checked for corneal clouding and regardless of the presence of eye involvement, they should be administered Vitamin A immediately. Vitamin A supplementation for measles significantly reduces morbidity and the case fatality rate (18, 19).

Children with **severe protein energy malnutrition** are most often severely Vitamin A deficient, either clinically or subclinically. Thus, all children with severe malnutrition should be treated with Vitamin A (17).

**The optimal dosages are as follows.** Between 0-5 months, 50,000 IU of Vitamin A should be given. Children between 6-12 months should be given 100,000 IU, while children over 12 months old should be given 200,000 IU.

A third dose of Vitamin A, 2 to 4 weeks after the 1st dose is often recommended in the case of measles. However, this is not an essential part of the treatment.

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**Slide 18  Vitamin A Supplementation**

While there are specific recommendations for treatment of vitamin A deficiency, **vitamin A supplementation as a preventative measure is recommended in areas where vitamin A deficiency is a public health problem.** Periodic supplementation with large doses of vitamin A, a fat soluble substance that is stored in the liver, protects against deficiency. For children over 12 months of age, 200,000 units IU will provide protection for up to 6 months. In the recommended doses there are rarely any serious or permanent adverse affects, although occasionally a tense, bulging fontanelle, headache or vomiting, which are transitory, do occur.

There are **two methods for vitamin A supplementation** at the community level, plus **one that is currently being studied.**
**Universal distribution** involves administration of supplemental vitamin A to all preschool children, especially children 6 months to 3 years of age. These distribution schemes should make vitamin A available before the onset of a season in which there is special risk for this deficiency, such as measles or diarrhoeal disease. The dose for infants, older than 6 months of age, is 100,000 IU at contact. Children over 6 months of age should receive 200,000 units orally every 4-6 months, and lactating mothers should receive 200,000 IU once within the first 2 months after delivery in order to supplement breast milk.

A second strategy in areas where vitamin A deficiency is a problem, and complimentary to universal distribution, is the **disease targeted distribution to high-risk children**. Children who are brought to the health facility with diseases such as diarrhoea and pneumonia would benefit from receiving vitamin A supplementation in order to replace losses during the disease. These doses should not be given to children who are known to have already received a high dose of vitamin A supplement within the preceding month.

**A third option, immunization-linked supplementation,** is essentially under study. This method uses routine immunizations as an opportunity for updating supplementation.
REFERENCES


