

**Transitioning to the WHO Growth Standards:
Implications for Emergency Nutrition Programmes
IASC Nutrition Cluster Informal Consultation**

Geneva, 25-27 June 2008

Meeting report

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Background

The introduction of the WHO Growth Standards in April 2006 represents a significant move forward in the understanding and measurement of global child malnutrition (WHO, 2006). The standards are normative and based on a carefully conducted study that monitored the growth of healthy children from around the world under conditions of optimal nutrition and health. However, there are important differences in the diagnosis of malnutrition when the standard cut-offs are applied with the NCHS/WHO Reference (referred to in the document as the *NCHS reference*) and the WHO 2006 Child Growth Standards (referred to in the document as the *WHO standards*).

The WHO standards are being adopted by countries and have already been used for emergency and non-emergency programming. The focus of this report and the informal consultation is on the use of the NCHS reference and WHO standards for 1) estimating prevalence of acute malnutrition in populations and 2) identifying individuals for supplementary and therapeutic feeding programs.

Preliminary, retrospective analysis of datasets has indicated that differences in cut-offs will result in changes in the measured prevalence of malnutrition at the population level, and the numbers of children eligible for therapeutic feeding and other anthropometrically targeted interventions. In the two published papers, the prevalence of severe wasting according to the WHO standards were 1.5-2.5 (for children aged 12-60 months) (de Onis M, 2006) and 1.7-4.2 times (for children aged 12-59 months) (Seal A, 2007) those derived from the NCHS reference, respectively, when this was determined using the weight-for-height Z-score. Larger differences were expected when transitioning between the NCHS reference percentage of the median (commonly used for admission to nutrition programmes) and WHO standards Z-score measurement systems. These findings have programmatic and resource implications.

Members of the IASC Nutrition Cluster felt that there was a lack of clarity on the implications of moving from using the NCHS reference to using the WHO standards for ongoing nutrition programmes and the initiation of new programmes.

Five background papers were commissioned to document the possible implications of the introduction of the WHO standards for emergency nutrition programmes.

1. Assessing the impact of the introduction of the WHO growth standards on the measured prevalence of acute malnutrition and the number of children eligible for admission to emergency feeding programmes. *M Myatt & A Duffield*

2. Comparing the screening power of NCHS and WHO anthropometric norms systems: A case study in Niakhar, Senegal. *M Garenne*

3. Relationship between anthropometric status and the risk of death of children admitted in MSF nutritional programmes. *N Lapidus, V Gaboulaud & R F Grais*

4. Assessing the impact of the introduction of the WHO Growth Standards on the response to treatment of severe malnutrition in children. *S Isanaka & V Gaboulaud*

5. Assessing the impact of the introduction of the WHO growth standards on feeding centre admissions, performance and resources needed, and reviewing the available software for calculation of acute malnutrition prevalence using WHO growth standards. *A Seal*

Furthermore, it was felt that a meeting was needed to examine the evidence gathered so far and to draw recommendations.

Objectives of the meeting

Objectives:

1. To examine the consequences of the use of the WHO child growth standards on the outcomes of malnourished children;
2. To provide an estimation of the changes in the assessment of the nutrition situation and in the number of malnourished children potentially eligible for therapeutic and supplementary feeding, with the introduction of the WHO standards;
3. To formulate recommendations for the use of the weight-for-height index of the WHO standards in emergencies and identify knowledge gaps that should be addressed.

Building on the recommendations of the five background papers commissioned by the Cluster, the meeting focused on the implications of the introduction of the WHO Growth Standards for children 6-59 months in emergencies on:

- Prevalence of acute malnutrition¹ estimated by nutrition surveys
- Cut-off values of weight-for-height index for admission of children to selective feeding programmes
- Number of children eligible for admission to therapeutic feeding and supplementary feeding programmes
- Relationship between anthropometric indicators used for admission of children to feeding programmes and risk of death
- The response to treatment of children admitted to therapeutic feeding programmes

The meeting did not discuss:

- Non-emergency contexts
- Implications for infants less than 6 months of age
- Other nutrition measurements or indices, such as height-for-age and weight-for-age.
- The comparative values of MUAC and weight-height for admission of children to feeding programmes. MUAC is considered as an independent criterion of admission to therapeutic feeding programmes.

¹ Acute malnutrition is defined by: wasting (assessed by weight-for-height) or/and bilateral pitting oedema

Summary of presentations and discussions

Implication of the use of WHO standards to estimate prevalence of acute malnutrition

From 1978 onwards, NCHS reference has been used to assess anthropometric nutritional status in children. The new WHO standards, developed on the results of the Multicentre Growth Reference Study and published in 2006, were designed to replace them.

The introduction of these new standards has consequences on the determination of nutritional status at individual and population level. When plotting weight against height for the cut-off of weight-for-height - 3 Z-score, for NCHS reference and WHO standards, it is clear that WHO standards identify more children with a weight-for-height less than - 3 Z-score. This varies according to a child's height. Less difference is seen when weight-for-height - 2 Z-score is used. If weight-for-height less than 70% of the median is used, WHO standards tend to identify less children below this cut-off than NCHS reference.

Moreover, studies based on a limited number of surveys indicated that a switch in weight-for-height Z-score from the NCHS reference to the new WHO standards would have little effect on the overall prevalence of Global Acute Malnutrition (GAM) or Moderate Acute Malnutrition (MAM), but will result in a significant increase in the prevalence of Severe Acute Malnutrition (SAM) (de Onis M, 2006; Seal A, 2007).

The first background paper commissioned by the Nutrition Cluster looked further at the impact of the introduction of the WHO standards compared to NCHS reference on the measured prevalence of acute malnutrition, using a database of more than 500 surveys (Myatt M, 2007). When weight-for-height in Z-score was used, results showed a small positive difference in the estimate of prevalence of GAM, a small negative difference in the estimate of prevalence of MAM and a larger positive difference in the estimate of prevalence of SAM. The relationships between the NCHS and WHO-based indices did not appear to be different in populations living in different locations, and there was no consistent difference in the median age of children classified as cases by the case-definitions.

During the discussion, it was noted that the WHO standards appear to classify children who were previously identified as moderately malnourished by NCHS reference as severely malnourished: when weight is plotted against height, the cut-off of 80% of the median NCHS reference is close to the cut-off of - 3 Z-score WHO standards while the cut-off of 70% of the median NCHS

reference is close to the cut-off - 4 Z-score WHO standards. It was suggested that new cut-offs of - 4 Z-score and - 3 Z-score to define moderate and severe malnutrition, respectively, be used with the WHO standards to remain consistent with the % of the median NCHS reference. On the other hand, using the WHO standards with the commonly used thresholds of -3 Z-score for defining severe acute malnutrition represents a shift towards a more preventative model of treatment, catching and treating cases earlier than is currently done.

It was also emphasized that when examining risk of mortality and weight for height, there is a gradual exponential increase in mortality risk when weight-for-height decreases. This pattern is found in both the NCHS reference and the WHO standards. There is no clear threshold indicated where mortality risk increases.

As the new WHO standards are adopted, operational factors in the management of acute malnutrition including financial and human resources need to be taken into consideration as well.

Converting prevalence estimates that are based on different standards/references

To be able to convert acute wasting prevalence estimates that have been calculated using the NCHS reference to a figure approximating an estimate had the WHO standards been used is important for a number of reasons. First of all, survey results calculated using either or both norms are likely to be reported for a number of years. In addition, coordinating bodies may need to compile a pool of comparable data sets for national or international use. And lastly, trend analysis may need to be performed using historical data. The relationship between the NCHS and WHO growth curves is complex and differences in prevalence will vary according to the profile of the survey sample in terms of length or height, and also sex. Due to this complex relationship between the indices calculated using the two norms, it is very important to calculate results using raw data whenever possible. However, in the event raw data are not available, it is still desirable to be able to convert prevalence estimates between the two norms for the reasons mentioned above.

Two methods have been proposed so far (Myatt M, 2007; Yang H, 2008). As statistical methods and databases used differed, one of which contained cases of oedematous malnutrition while the other did not, identical conversions were not expected. Predicted GAM prevalence estimates for WHO standards from estimates calculated with NCHS reference were calculated using the two equations for a range between 10 and 20%. The difference between the two ranged from 1.3 to 1.5%.

In comparing the two methods, it was found that the method proposed by Myatt allows for the prediction of both GAM and SAM prevalence from existing summary data and that conversions can be done in both directions, i.e. from NCHS reference to WHO standards and from WHO standards to NCHS reference. The method of Yang only allows for prediction of prevalence of wasting (weight-for-height Z-score <-2) measured using WHO standards from wasting measured using NCHS reference. However, it was felt that the methodology used by Yang was stronger- as it eliminates the risk of obtaining negative prevalence values by using a logit transformation- and that the algorithm proposed can be used. Also, Yang's work was published in a peer reviewed journal while the other paper is a report. To further validate this method and allow for conversion of prevalence of severe wasting, a recommendation was made that Myatt dataset be reanalysed in line with Yang methodology, for calculating GAM and SAM while considering oedema independently. Results from this work would also benefit from publication in a peer-reviewed journal. Nevertheless, it was re-emphasised that due to the complexity of the relationship between the two norms, conversion of data on prevalence would be anyway imprecise and that raw data should be used whenever possible. It was also noted that confidence intervals and background information on presence of aggravating factors and trends in prevalence of GAM were key to interpret results of nutrition surveys.

Software tools for application of Standards/references

In emergency nutrition work, it is desirable to have software for analysing nutrition survey data that requires a minimum of pre-service training, is easy and quick to use, and produces results in a standardised format. This facilitates efficient report preparation and aids appropriate decision-making by the users of the information.

Software available for use in the calculation of weight-for-height Z-score and percentage of the median from the NCHS reference, and the calculation of Z-scores from the WHO standards was therefore assessed on the basis of ease of use and compatibility of the results generated with the standard reporting formats used in emergency nutrition surveys and assessments. Tools available include WHO software, EPI Info and ENA (Emergency Nutrition Assessment) software for SMART. The ENA tool appeared to be the most user-friendly and easiest to use, but a major limitation is that it can analyze anthropometry and mortality data, but no other variables. An add-on installation file compatible with Epi-info and which will have the main features of ENA is to be soon released by CDC. A new version of ENA is also planned, which will make the analysis of additional variables possible.

Relationship between weight-for-height index, calculated with NCHS reference and WHO standards, and the risk of death

In an attempt to compare the screening power of the NCHS and WHO anthropometric norm systems, an analysis of data taken from a demographic surveillance study in Niakhar, Senegal, 1983-1986, was performed (Garenne M, 2007). Results showed only minor difference between the two systems either in percentage of the median or Z-score in terms of screening power. However, the WHO system does appear to have somewhat better specificity, although at a cost of lower sensitivity. None of the systems showed better performance than Mid-Upper-Arm-Circumference (MUAC).

The same type of analysis was conducted on data from an MSF feeding programme in Maradi, Niger (Lapidus N, 2007). The WHO standards, either in percentage of the median or in Z-score, were found to be both more sensitive and more specific than the NCHS reference. The gap between the two shortened as the age of the child increased.

During the discussion, it was noted that the relationship between an indicator and the risk of death will vary according to the length of the follow-up. For MUAC, the best sensitivity and specificity are achieved for a follow-up of one month, compared to follow-up of 3 and 6 months.

Implication of changing criteria of admission to therapeutic feeding programmes

The adoption of the WHO standards will pose the question of whether or not it is necessary to modify the cut-off points currently being used to classify moderate and severe acute malnutrition. When deciding the need for treatment, in addition to being below a certain cut-off, it is also useful to consider other factors such as sensitivity and specificity of the indicator, risk in the absence of treatment, response to treatment, the risk of treatment and finally, the cost of treatment.

Data presented showed that, compared to NCHS reference, the use of WHO standards weight-for-height with a cut-off of -3 Z-score for defining severe acute malnutrition will select more children who have a high risk of death and who will benefit from treatment with therapeutic diets (Briend A, 2008). In addition, there are very few children below this cut-off in a well nourished population, meaning that this criterion will still target the most at risk. Moreover, it seems that there is virtually no risk of treatment. Based on similar evidence, it was further suggested that there is a need to re-evaluate the current MUAC cut-off for severe acute malnutrition of 110 mm and consider increasing it to a higher cut-off of 115 mm.

The presentation also emphasized that by keeping the same weight-for-height criteria (-3 Z-score of the WHO standards) already in use with the NCHS reference, children diagnosed as severely malnourished will begin receiving treatment earlier in their disease course, which in turn is likely to make it easier to reverse the damage of worsening nutrition. As a result, fewer complicated severe cases requiring inpatient treatment are expected and it is also possible that programmes aimed at treating moderate malnutrition through supplementary feeding will see a reduction in case load.

Other data presented suggested that NCHS reference Z-score is strongly biased to admit older children and against high risk younger children, compared to NCHS reference % of the median (Golden M, 2008). It therefore doubles the admissions compared to when using percentage of the median, with little benefit to the programme. WHO standards Z-score is less biased and admits many more children less than 73 cm of height, who are at highest risk of death, and fewer children over 73 cm. As most severely malnourished children are less than 73 cm, the numbers admitted would increase between two and five fold. On the other hand, <70% of median of WHO standards seems quite stringent and denies admission to many children at high risk of death. Data derived from WHO standards also appear to follow a weight and height-based index of mortality risk of children in therapeutic feeding programmes more closely than data derived from the NCHS reference.

The WHO standards were presented as having several advantages over the NCHS reference. They do not discriminate against the high risk younger child to the same extent as the NCHS reference. Many more children in need of special treatment to avert death will be included in the programmes. Use of the WHO standards should also lower the mortality rate from severe malnutrition. On the other hand, in addition to the increase in programme numbers, the application to field workers of the concept of the Z-score is more complicated than the percentage of the median and may be difficult to adopt easily.

However, it was noted during the discussion, that, from a practical perspective in terms of using the charts of weight-for-height, whether charts are based on Z-score or percentage of the median does not really matter.

An analysis of secondary data from MSF feeding programmes in Niger compared the programme beneficiary population when using both the new WHO standards and the NCHS reference (Isanaka S, 2007). Results showed that children admitted on WHO standards weight-for-height Z-score compared to NCHS reference % of the median or Z-score, tended to have a higher weight-for-height and were younger. Treatment duration was shortened, recovery rates were higher and

fewer cases required transfer to inpatient care. Weight gain was, on average, lower, but still substantial. WHO standards percentage of the median will tend to admit children with a lower weight-for-height and outcomes will generally be somewhat less favourable, compared with percentage of the median of NCHS reference.

The decision to keep or to change existing cut-offs raised many outstanding issues. Concern was expressed that some implementing partners may decide not to adopt the new WHO standards simply because they consider the subsequent increase in programme cost and size is beyond their capacity. In general, the participants agreed that best practice of using WHO standards should still be emphasized even if full implementation might not be immediately achievable. However, the results presented highlight the need to consider the impact that the move to WHO standards would have on implementing agencies and their capacity to deal with the increased case load and the allocation of finite funds and resources. Also, while discussion was mainly limited to emergency settings, it was recognized that more examination is required to determine what implications exist in the adoption of WHO standards in post-emergency and development contexts.

Currently some organisations base their screening tools (e.g. charts of weight-for-height using NCHS reference) on a combined reference for boys and girls. Others separate the two. It was decided that more research needs to be done to determine whether a sex-combined table needs to be developed for use with the new standards. This might ease determination of nutritional status in the field but will depend on sex-specific relationship between mortality and weight-for-height index. This would require a manipulation of median and Z-score values for the various measures and has analytical implications. Another aspect is that simply averaging the median weight or height or other manipulations may include or exclude one sex over another. More work is needed to ensure that the combination of standards for boys and girls reflects statistical and biological relevance.

Implication of changing norms on the number of children admitted to feeding programmes and resources required

A re-analysis of the Myatt data set was conducted in order to further evaluate the change in programme resource allocation that the transition to WHO growth standards would require (Seal A, 2007). The analysis looked at changes in the number of situations that would require intervention according to the classification and framework for action proposed by WHO and their

cost implications. Results mirrored some of those discussed previously. There was little or no change to the prevalence of global acute malnutrition, however, the difference in the number of surveys classified as acceptable (prevalence of weight-for-height < -2 Z-score less than 5%) and critical (prevalence of weight-for-height < -2 Z-score equal to or more than 15%) was -7% and +9%, respectively. The need for targeted supplementary feeding programmes would remain approximately the same while blanket feeding programmes would increase by around 9% and therapeutic feeding programmes by 6%, representing a 362% increase in the absolute number of children that would be eligible for admission to therapeutic feeding programmes. However, for the same weight gain, the average duration of treatment would be less for a child admitted using weight-for-height less than -3 Z-score of the WHO standards and discharged with a weight-for-height more than -1 Z-score of the WHO standards than for a child admitted with a weight-for-height less than 70% of the median of the NCHS reference and discharged with a weight-for-height more than 85% of the NCHS reference.

An economic model has been developed to predict the change in resource requirements associated with the introduction of the WHO standards into emergency nutrition programmes. When the reduction in duration of treatment is taken into account the model predicts that although there would be a median increase of about 4 fold in the number of potential patients, the median cost of treatment would only double. However, the increase in patient numbers seen in an analysis of 560 surveys ranged from 1 – 30 folds so the relative increase in resources that would be required in any one particular setting is very broad. A substantial increase in additional funding to enable the additional therapeutic feeding programme patient load to be managed effectively will be required. To facilitate a smooth transition a number of related steps would be needed. One of these would be to engage donors with a clear explanation of the advantages of the new diagnostic criteria and a justification for the additional funding that would be requested for this aspect of their humanitarian funding.

Discussion of duration of stay and weight gain raised the question of cut-off points for discharge from feeding programmes and the need for caution when making comparisons between the two systems. The diagnostic cut-off of -3 Z-score is not the same in the two systems; therefore treatment implications may not be the same either. Moreover, these projected cost increases assume that programme cut-offs for admission and discharge remain the same. A change in either criterion might result in very different costs.

It was also emphasized that consideration needs to be given to the use of the GAM-based WHO classification of emergency situations and framework for selective feeding implementation (trigger prevalence of GAM and aggravating factors for intervention) to determine if the criteria are still

appropriate for use with the proposed WHO standards. The need for further research on this subject was determined to be critical.

Using the 2006 data from MSF feeding programmes in Niger, the numbers of children eligible for admission into therapeutic feeding programmes by the NCHS reference and the WHO standards using Z-score and percentage of the median was estimated (Isanaka S, 2007). When looking at Z-score, the WHO standards captured nearly all the children identified by the NCHS reference, with few exclusions. Nearly four times as many children were added to the programme with the WHO standards, with many of the new addition falling in the 6-12 month age range. A decrease was also noted in the proportion of the overall admissions represented by the 13-24 month category as well as a small decrease in the percentage of boys. Less overlap in identification was noticed when comparing WHO standards and NCHS reference percentage of the median. Using the percentage of the median criterion, there was a considerable proportion of children excluded using the WHO standards, compared to those identified by the NCHS reference, and overall programme size was reduced. There were more young children admitted, but no difference was observed in the sex distribution of children newly identified by the WHO standards and those identified by the NCHS reference. The largest difference was found when comparing the WHO standards Z-score to NCHS reference percentage of the median. No one was excluded when using WHO standards Z-score, while there was an eight-fold increase in the total number of admissions. Younger children were more likely to be admitted and there was a slight increase in the proportion of boys. Impact of the transition to WHO standards will generally depend on the age, weight and height distributions of the population and on the criterion used. In this population, transitioning to the WHO standards with the Z-score criterion from the NCHS reference with the percent of the median criterion would increase the total number of children identified by eight times. Most of these additions were concentrated among younger children (6-12 months).

Update on the introduction on the WHO standards at country level

While the WHO standards have not yet been fully adopted by many agencies working in emergency settings, many countries are already using the new standards in some capacity (Onyango A, 2008). In general, the new standards have been well-received. Currently, 75 countries have already officially adopted, or partially adopted, the new WHO standards. Another 60 countries are in the process. Many have integrated height as a measure to be taken for growth monitoring, although this has not been incorporated into official recommendations. They are also being used for DHS and MICS surveys and by some UN partner agencies.

The discussion pointed out the lack of consistency in new WHO standards adoption among the many NGOs working in the field. The change to the WHO standards is taking place slowly and even less so in programmes. Some agencies are using them to report prevalence in survey reports or when starting new programmes, especially those that are in collaboration with government agencies in countries who have already adopted the standards.

Many agencies expressed the need for guidance or a formal recommendation from normative agencies and coordinating bodies, specifically on the subject of admission and exit criteria for emergency programmes. It was also recognized that there is a need to emphasize clarity in reporting. As is, there is a lot of confusion among agencies and it is not always clear which norm, and which measurement system (Z-score or % of the median), is used. The recommendation was made for reporting results using both WHO standards and NCHS reference with a clear designation of which source was used.

Conclusions and guiding principles

The relevance and importance of using the new WHO standards in emergency nutrition programmes was agreed upon. It was concluded that the new standards would identify children at higher risk for dying from severe acute malnutrition at an earlier stage, making them easier to treat at a lower individual cost. Reducing mortality related to malnutrition would have a major public health impact by lowering disease burden and DALY's. The added costs and resources required to treat the expected increase in cases is significant though and needs to be addressed not only by implementing agencies, but also by governments and within the donor community. In addition, there are still several outstanding questions which need further investigations.

Participants agreed on the following guiding principles for the transition to WHO standards in emergency nutrition programmes:

Admission and discharge criteria to therapeutic and supplementary feeding programmes

1. Weight-for-height using the WHO standards expressed in Z-score for children 6-59 months be used as admission and discharge criteria to therapeutic and supplementary feeding programmes.
2. The admission criteria to therapeutic programmes be set at < -3 Z-score WHO standards and/or bilateral oedema.
3. The admission criteria to supplementary programmes be set at ≥ -3 & < -2 Z-score WHO standards.
4. In addition, MUAC continues to be used as an independent criterion for admission. However, it is recommended that current cut-offs be reviewed and revised as followed: SAM - MUAC < 115 mm; MAM - MUAC ≥ 115 mm & < 125 mm, for children from 6 months of age.
5. The discharge criteria for severe acute malnutrition be set at: Weight-for-Height Z-score ≥ -2 of the WHO standards; 20% weight gain for children admitted by MUAC, and MUAC higher than admission criteria; oedema free for at least 10 days; child is clinically well and alert.
6. There is an urgent need to review discharge criteria for supplementary feeding programmes. In the interim, it is recommended to continue using current guidelines, using cut-offs in WHO standards equivalent to that in NCHS reference.
7. Use separate boys and girls reference charts for admission and discharge until further evidence supports using sexes combined.

Estimating of prevalence of acute malnutrition in surveys

1. For reporting purposes, survey results be reported using both the NCHS reference and the WHO standards until the WHO standards have been fully adopted. Initially, the main results would continue to be given in NCHS reference.
2. MUAC be included in surveys for estimating case load as MUAC is considered as an independent criterion of admission to therapeutic feeding programme for infants and children over six months of age. Combination of children meeting the criteria of MUAC, weight-for-height and oedema be used to estimate the number of children that would require treatment.

Ensuring a smooth transition from NCHS reference to WHO standards, including resource implications

1. WHO compiles a list and map of countries that have already adopted the new standards and those who are in the process, which is to be updated quarterly.
2. Global and country nutrition clusters produce a list of NGOs that are using the new standards for survey reporting and for programme admissions, which is to be updated quarterly.
3. Support and guidance for the transition be provided by WHO and others through a training package, including technical and operational fact sheets and increased training on the use of software including the WHO standards, such as ENA for SMART, the upcoming EpiInfo for windows/ENA (CDC/SMART) and the WHO Anthro.
4. A statement be issued by international agencies on the use of WHO standards in feeding programmes and for surveys in emergencies.
5. Transition to the WHO standards be used as an opportunity for advocacy towards the treatment and prevention of acute malnutrition

Research gaps that need to be addressed

1. Examination of the most appropriate discharge criteria for MAM and SAM, also in the light of new products that are being proposed for treatment and prevention of acute malnutrition.
2. Development of MUAC criteria for admission to MAM treatment facilities as an independent criteria (given the recommendation to the normative agencies to change to <115 for SAM.)
3. Work on the appropriate weight gain and other indicators for programme monitoring, including updates in guidelines such as Sphere.
4. Examination of the risk of mortality and response to treatment in boys and girls to decide whether sexes combined charts could be appropriate for use in feeding programmes.

5. Investigation of the use of absolute MUAC values as discharge criteria and for monitoring purposes: evolution of MUAC throughout treatment.
6. Follow up of the progress and response to treatment of children admitted with MUAC or weight-for-height and discharged with a % weight gain.
7. Further study on the method used to calculate prevalence of acute malnutrition according to WHO standards from prevalence calculated with NCHS reference without raw data.
8. Refinement of the methodology for estimating the number of children in the population in need of treatment (combining weight-for-height Z-score, MUAC and presence of bilateral pitting oedema). Ideally, incidence data should be used. However, they are seldom available and research should be conducted on estimating incidence from prevalence.
9. Refinement of the methodology for estimating programme coverage.
10. Re-examination of the decision thresholds of nutrition emergencies and interventions currently used with the NCHS reference, including evidence base, practical utility and actual use in different contexts. In line with these investigations, derive thresholds relevant to the WHO standards.

Next steps

In follow-up of the meeting, it is expected that normative (such as WHO) and co-ordinating agencies (such as UNICEF) will lead the process of transitioning from NCHS reference to the WHO standards. Further action will include the creation of a technical fact sheet, as well as an operational road map, to help guide agencies through the process of adoption. A joint statement should also be issued by international agencies to give guidance on the transition to WHO standards in the treatment of acute malnutrition. Various authors of the review papers are encouraged to get their work published in peer-reviewed journals. The outcome of this meeting should be taken into account in the revision of guidelines, manuals and training packages related to nutrition in emergencies. The research questions identified in the consultation, such as the need to review the classification of emergency situations as well as feeding programme admission and exit criteria, will be followed up. Children 0-5 months of age were not discussed during this meeting as it was felt that issues around this age group need separate work. This should be tackled urgently.

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Transitioning to the WHO Growth Standards: Implications for Emergency Nutrition Programmes

IASC Nutrition Cluster Informal consultation 25-27 June 2008

Salle 1
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Agenda

Wednesday, 25 June

S1: Morning Session 1 - Introduction

09.00- 09.30 Introduction (*Bruce Cogill, Nutrition Cluster coordinator; Oleg Bilukha/Mija Ververs, Assessment Working Group co-chairs*)

- Opening remarks
- Objectives of the meeting
- Introduction of participants
- Nomination of Chairperson and rapporteur

S2: Morning session 2 (09.30-12.00)

Objective: What are the implications of the WHO Growth Standards on the estimation of the prevalence of acute malnutrition?

09.30 - 10.00 The use of NCHS reference and WHO standards to estimate prevalence of acute malnutrition. Background Paper 1. *Presented by C Prudhon (SC), on behalf of A Sea (UCL Centre for International Health and Development)*

10.00 - 10.30 Discussion

10.30 - 11.00 *Coffee/Tea*

11.00-11.30 Is it possible to derive prevalence of acute malnutrition according to WHO growth standards from prevalence calculated with NCHS reference without raw data? Background paper 1. *Presented by C Prudhon (SCN), on behalf of A Seal (UCL Centre for International Health and Development)*

11.30-12.00 Discussion

12.00 - 13.00 Lunch

S3: Afternoon session 1 (13.00-14.30)

Objective: What is the relationship between anthropometric indices and the risk of death?

13.00 - 13.30 Comparing the screening power of NCHS and WHO anthropometric norms systems: A case study in Niakhar, Senegal. Background paper 2. *M Garenne (Institut Pasteur)*

13.30 - 14.00 Relationship between anthropometric status at admission and the risk of death of children admitted in MSF nutritional programmes. Background paper 3. *N Lapidus (Epicentre)*

14.00 - 14.30 Discussion

S4: Afternoon session 2 (14.30 - 17.00)

Objective: What is the implication of changing criteria of admission to therapeutic feeding programmes?

14.30 - 15.00 Assessing the impact of the introduction of the WHO Growth Standards on the response to treatment of severe acute malnutrition. Background paper 4. *S Isanaka (Harvard School of Public Health)*

15.00 - 15.30 Operational implications of the new WHO growth standards -Is there a need to redefine cut-off points between moderate and severe wasting? *A Briend (WHO)*

15.30 - 16.00 The use of the WHO Growth Standards for admission to therapeutic feeding programmes. *Presented made by A Briend (WHO) on behalf of M Golden (University of Aberdeen)*

16.00 - 16.30 *Coffee/Tea*

16.30 - 17.30 Discussion

Thursday 26 June

09.00 – 09.15 Rapporteur: Summary of day 1 presentations.

S5: Morning session 1 (9.15 - 10.30)

Objective: What is the implication of changing norms on the number of children admitted to feeding programmes and the resources required?

9.15 - 9.30 Change in the number of children eligible for admission to feeding centres, estimated from prevalence of nutrition surveys, and resource implications. Background paper 5. *Presented by C Prudhon (SCN) on behalf of A Seal (UCL Centre for International Health and Development)*

9.30 - 10.00 Change in the number of children eligible for admission to therapeutic feeding programmes, a case-study from Niger. Background paper 4. *S Isanaka (Harvard School of Public Health)*

10.00-10.30 Discussion

10.30-11.00 *Coffee/Tea*

S6: Morning session 2 (11.00-12.00)

Objective: Introduction of the WHO growth standards at country level, where are we?

11.00- 11.30 Update of WHO on the introduction of the WHO Growth Standards at country level. *A Onyango (WHO)*

11.30 - 12.00 Discussion

12.00 - 13.00 Lunch

S7: Afternoon session (13.00-17.30)

Objective: Determine areas of consensus and knowledge gaps - Determine recommendations - Group work - 2 groups

13.00 - 13.30 Introduction of working groups

13.30 - 15.30 Working group work; Groups A and B working in parallel

15.30-16.00 *Coffee/Tea*

16.00-16.30 Presentation of Group Work A

16.30-17.00 Discussion and recommendations

Friday 27 June

09.00 – 09.15 Rapporteur: Summary of day 2 presentations.

S8: Morning session (9.15 - 12.30)

Objective: Determine areas of consensus and knowledge gaps - Determine recommendations - Group work - 2 groups (continued)

9.15 - 9.45 Presentation of Group Work B

9.45 - 10.45 Discussion and recommendations

10.45 - 11.15 *Coffee/Tea*

11.15-12.15 Discussion, consolidated recommendations and next steps

12.15-12.30 Closing of meeting (Bruce Cogill)

Abstracts of presentations

The use of the NCHS reference and WHO standards to estimate prevalence of acute malnutrition. *Presented by C Prudhon, SCN, on behalf of A Seal, UCL Centre for International Health and Development*

The Multi-centre Growth Reference Study (MGRS) represents an extremely detailed and careful construction of a global growth standard, based on state-of-the art nutrition knowledge. The new WHO growth standards, developed on the results of the MGRS study and published in 2006, were designed to replace the 1978 NCHS/WHO reference that have been used so far. However, little data on the public health implications of using the WHO growth standards are available.

In 2006, a study was done to assess the implications of adopting the new growth standards in the operation of emergency and non-emergency child feeding programmes. Using secondary data from three nutrition surveys in varying contexts, the weight-for-height z-score and % of the median for moderate and severe acute malnutrition were tabulated from the NCHS/WHO reference and the WHO 2006 growth standards. Results of the study indicated that a switch to the new WHO standards would have little effect on the overall prevalence of global acute malnutrition (GAM) or moderate malnutrition (MAM). However, the use of WHO 2006 standards in weight-for-height z-score would result in a significant increase in the prevalence of severe acute malnutrition. On the other hand, if % of the median cut-offs were used, as was standard practice, severe malnutrition was likely to be under diagnosed.

Further to this study, a background paper commissioned by the Nutrition Cluster looked at the impact of the introduction of the WHO standards compared to NCHS reference on the measured prevalence of acute malnutrition. The analysis conducted by M Myatt and A Duffield used a database of 560 surveys from 31 countries contributed by a range of operational Non Governmental Organisations. Results showed that with the use of WHO Growth Standards in Z-score, compared to NCHS/WHO reference in Z-score, there was a small positive but variable change in the median prevalence of global acute malnutrition and large proportional increase of the median prevalence of severe acute malnutrition (from 1.34% to 2.71%). When percentage of the median NCHS (currently used as admission criteria to feeding centres) was compared with Z-score WHO standards, the median prevalence of need for supplementary feeding programme treatment showed a small proportional increase (from 6.85% to 7.78%) while the median prevalence of need for therapeutic feeding programme treatment showed a large proportional increase (from 0.7% to 2.71%). The relationship between the NCHS and WHO based indices did not appear to be different in populations living in different locations, and there was no consistent difference in the median age of children as classified as cases by the case-definitions.

Is it possible to derive prevalence of acute malnutrition according to WHO growth standards from prevalence calculated with NCHS reference without raw data? *Presented by C Prudhon, SCN, on behalf of A Seal, UCL Centre for International Health and Development*

Availability of suitable software for analysing nutritional surveys and calculating prevalence of acute malnutrition is critical to facilitate use of any growth norm. A review of available software, including WHO software, EPI Info and ENA (Emergency Nutrition Assessment) software for SMART, was conducted for the Nutrition Cluster. Recognising that the choice of software will depend, for many workers, on a number of factors, such as previous experience, training and technical knowledge, some recommendations on software were nevertheless made. For anthropometry analysis in standardised nutrition surveys, ENA stood out as being the most user friendly and providing the highest level of functionality. However, no other variables than the core SMART indicators can currently be analysed and another software still needs to be used for these. Moreover, ENA does not include the functionality for surveys with more complex design including strata or requiring sample weighing. In this case, analysis with one of the Epi Info packages is recommended.

Although, because of the complexity of the relationship between the NCHS and WHO growth curves, it is very important to calculate results by using raw data whenever possible, it is still useful to be able to convert between prevalence estimates made using the NCHS reference and the WHO growth standards. Two methods have been proposed so far. The first method was developed by Myatt in a report to the Nutrition Cluster in 2007. It is based on a database of 560 nutrition surveys from which ordinary least squares linear regression equations were derived for converting global and severe acute malnutrition from prevalence estimates in NCHS/WHO reference to WHO standards and the reverse. These equations were derived from a database of surveys that included oedematous malnutrition. The second method comes from work published by Yang in 2008. It is based on an analysis of sixty-eight surveys from the WHO Global Database on Child Growth and Malnutrition from which a simple linear regression was generated, using the NCHS and WHO prevalence estimates of wasting after logit transformation. Oedema cases were not included in the dataset. The performance of the formula was validated on 65 national/regional surveys selected from the WHO global database that were not included in the estimation. The conversion formula was incorporated into a downloadable spreadsheet.

**Comparing the screening power of three anthropometric norms systems:
A case study in Niakhar, Senegal.** *M Garenne, Institut Pasteur, France*

Two systems of anthropometric norms for pre-school children were compared: the 1977 NCHS reference and the 2006 WHO Growth Standards. Two indicators were used for the comparison: weight-for-height standardized by Z-scores and Percentage-of-median. The study first compared the median values and the left deviation of the indicators. In addition, the two systems were applied to the same empirical data set, originating from Niakhar in Senegal, which included anthropometric measurements of 12,638 children aged 6-59 months, and their survival over the following six months. This allowed for comparison of estimates of prevalence of wasting, as well as mortality attributable risks, sensitivity and specificity of the indicators for various thresholds.

Results show only minor variations between the norm systems. Estimates of prevalence of severe malnutrition with Z-score were the most sensitive to the choice of the reference set, with a range as high as 1 to 2.8. Both systems showed a similar Logit-linear relationship between survival and anthropometry. Both systems had similar values of attributable risk, sensitivity and specificity, and similar Receiver Operating Characteristic (ROC) curves. Altogether, both systems provided valuable screening tools for mortality risk, and their differences remained of small magnitude. In any case, none of them showed better performances for screening high risk children (in terms of attributable risk, sensitivity and specificity) than mid-upper arm circumference (MUAC) measured directly (un-standardized).

Relationship between anthropometric status at admission and the risk of death of children admitted in an MSF nutritional program. *N Lapidus, V Gaboulaud, RF Grais, Epicentre, France*

Important differences exist in the diagnosis of malnutrition when comparing the 2006 World Health Organization (WHO) Child Growth Standards and the 1977 National Center for Health Statistics (NCHS) reference. However, their relationship on mortality has not been studied. Here, we assessed their accuracy at admission to detect the risk of death in malnourished children admitted to a large nutritional programme in Niger.

We analysed data from 64,484 children aged 6-59 months admitted with malnutrition in 2006 into the Médecins Sans Frontières (MSF) nutritional program in Maradi, Niger. Sensitivity and specificity of weight for height (W/H) in terms of Z score (WHZ) and percentage of the median (WH%) for both WHO standards and NCHS reference were calculated. Sensitivity and specificity of mid-upper arm circumference (MUAC) was also calculated. The receiver operating characteristic (ROC) curve was traced for these indicators and its area under curve (AUC) estimated.

In predicting mortality, NCHS reference using WHZ and WH% showed AUC values of 0.63 (95%CI: 0.60 - 0.66) and 0.71 (0.68 - 0.74), respectively. WHO standards using WHZ and WH% appeared to provide higher accuracy with AUC values of 0.76 (0.75 - 0.80) and 0.77 (0.75 - 0.80), respectively. The relationship between MUAC and mortality risk appeared to be relatively weak, with AUC = 0.63 (0.60 - 0.67), although this AUC may have been underestimated in this population.

These results suggest that the WHO standards are a more accurate indicator to predict mortality risk in this population of malnourished children, compared with NCHS reference. Future studies should examine both malnourished and healthy children when assessing the sensitivity and specificity of child growth references.

Assessing the impact of the introduction of the WHO Growth Standards on the response to treatment of severe wasting *S Isanaka, Harvard School of Public Health, USA, RF Grais, Epicentre, France*

Objective To assess the impact of adopting the World Health Organization Child Growth Standards (WHO standards) on the response to treatment of severe acute malnutrition in children, compared with the use of the National Center for Health Statistics (NCHS)/WHO growth reference (NCHS reference).

Study Design We used data from children aged 6-59 months with moderate or severe acute malnutrition who were admitted to the Médecins sans Frontières malnutrition treatment programme in Maradi, Niger during 2006 (n=56,214). Differences in weight gain, duration of treatment, recovery from malnutrition, death, loss to follow up, and need for inpatient care were compared for children identified with severe acute malnutrition according to the NCHS reference vs. the WHO standards. Severe acute malnutrition was defined using the weight-for-height (WFH) < -3 Z score and WFH < 70% of the median criteria.

Results Using the Z score criterion, children who were newly identified as severe acutely malnourished by the WHO standards had lower weight gains, shorter durations of treatment and higher rates of recovery. The frequencies of death, loss to follow up, and need for inpatient care among children who were newly identified as severe acutely malnourished by the WHO standards were approximately half of that observed in children identified by the NCHS reference. Children excluded under the WHO standards and Z score criterion had significantly greater recovery and lower need for inpatient care. Similar trends in the differences in treatment response were found when applying the same WFH < 70% of the median criterion to both the NCHS reference and the WHO standards and when applying the percent of median criterion to the NCHS reference and the Z score criterion to the WHO standards.

Conclusions The introduction of the WHO standards to identify children for admission into therapeutic feeding programmes would imply the inclusion of children who have fewer medical complications requiring inpatient care and are more likely to experience shorter durations of treatment and greater rates recovery. The WHO standards might become a useful tool for the early detection of acute malnutrition in children, although further research on the resource implications of this transition is required.

Operational implications of the WHO growth standards - Is there a need to redefine the cut-offs between moderate and severe wasting ? *A Briend, Z Weise Prinzo, C Gegout, World Health Organisation*

The WHO growth standard for weight-for-height classifies two to four times as many children below -3 z scores as the previously recommended NCHS reference. This cut-off is for identifying children in need of therapeutic feeding. Available evidence suggests that the same cut off should be used with the WHO standard. First, there are virtually no children below -3 z-score weight-for-height. In a well nourished population, about 14 children in 10,000 will fall below this threshold. Second, reanalysis of past studies shows that children below this cut-off with the WHO standard have a highly increased risk of death compared to children above this cut-off. Third, these children have a higher weight gain when receiving therapeutic diet than when receiving diets recommended to treat moderately wasted patients. Eventually, there is virtually no risk in giving these children a therapeutic diet. Based on the same arguments, it seems advantageous to increase to 115 mm the cut-off point used to define severe acute malnutrition with mid-upper arm circumference (MUAC).

Children selected with weight-for-height assessed using the WHO standard or with the cut-off of 115 mm for MUAC seem to have fewer complications and to respond better to treatment than those selected with the NCHS reference. Despite an expected increased patient load, and increased programme costs, programme managers are encouraged to move to the WHO standards keeping the same cut-off to improve the management of children with severe acute malnutrition.

The use of the WHO growth standards for admission to therapeutic feeding programmes. *Presented by A Briend, World Health Organisation, on behalf of M Golden, University of Aberdeen*

NCHS percentage of the median is the current standard weight-for-height criterion for admission to therapeutic feeding programmes. When compared to the NCHS z-score, percentage of the median is easier for field workers to understand and to calculate. In addition, standards are available from birth to adulthood, meaning a single method can be used for babies, toddlers, older children and adolescents. Compared to NCHS % of the median, the use of NCHS z-score nearly doubles the number of children admitted to TFP. However, the additional children are older and at lower risk of death. Furthermore, the Z-score discriminate against younger children at high risk of death.

Data derived from WHO standards appear to follow a weight and height-based index of mortality risk of children in therapeutic feeding programmes more closely than data derived from the NCHS reference. The $-3Z$ score correlates to an approximate 2% risk and 70% of the median to a 5% risk of death. Compared to NCHS z-score, WHO z-score is less biased and admits many more children less than 73 cm, who are at highest risk of death, and fewer children over 73 cm. As most severely malnourished children are less than 73 cm, the numbers admitted would increase between two and five fold. On the other hand, <70% of median of WHO standards seems quite stringent and denies admission to many children at high risk of death.

The advantages of the WHO standards in Z-score are that many more children in need of special treatment to avert death will be included in the programmes which should also lower the mortality rate from severe malnutrition. On the other hand, their use will greatly increase patient load and the concept of the z-score is more complicated than the percentage of the median and may be difficult to understand for non-statisticians.

Change in the number of children eligible for admission to feeding centres, estimated from prevalence of nutrition surveys, and resource implications.
Presented by C Prudhon, SCN, on behalf of A Seal, UCL Centre for International Health and Development

When assessing the resource implications of adopting different diagnostic criteria for severe acute malnutrition (SAM), two things were considered: the number of children diagnosed as requiring treatment and the cost of providing that treatment.

Firstly, Myatt's dataset comprising the results from 560 nutrition surveys carried out in 31 different countries was re-analysed to compare the number of scenarios, according to the framework for action proposed by WHO, that would be classified as requiring selective feeding interventions and the number of individuals requiring treatment, if the NCHS reference or WHO standards were used. Secondly, the duration of treatment involved using of the different diagnostic criteria was examined. Finally, the costs of treatment were considered drawing on the estimation for changes in the number of potential programme beneficiaries and the average duration of treatment.

Results showed that the need for targeted supplementary feeding programmes would remain approximately the same while the number of surveys indicating the need for blanket feeding programmes would increase by around 9% and therapeutic feeding programmes by 6%. This represented a median increase of 4.3 fold (range 1-30) in the number of children that would be eligible of admission to therapeutic feeding programmes.

For a child of the same length, the average duration of treatment would be less for a child admitted using weight-for-height less than -3 Z-score of the WHO standards and discharged with a weight-for-height more than - 1 Z-score of the WHO standards than for a child admitted with a weight-for-height less than 70% of the median of the NCHS reference and discharged with a weight-for-height more than 85% of the NCHS reference.

Based on the above scenarios and on a cost estimate of US\$ 0.40 per day per child for treatment of moderate malnutrition and an average duration of treatment of 90 days, it was estimated that operating costs for supplementary feeding programmes would rise by 4%. Change in costs for treatment of severe acute malnutrition would increase by 97%. However, it should be noted that programme costs do not increase in direct proportion to the number of patients. Although the median estimate indicates four times as many patients would be eligible for treatment when using diagnostic criteria based on the WHO 2006 Growth Standards, the total programme costs associated with this increase would only double.

Assessing the impact of the introduction of the WHO Growth Standards on the number of children eligible for admission to therapeutic feeding programs: Case Study from Niger, 2006. *S Isanaka, Harvard School of Public Health, USA, R F Grais, Epicentre, France*

Objective To assess the impact of adopting the World Health Organization Child Growth Standards (WHO standards) on the number of children eligible for admission in therapeutic feeding programmes, compared with the use of the National Center for Health Statistics (NCHS)/WHO growth reference (NCHS reference).

Study Design We used data from children aged 6-59 months with moderate or severe acute malnutrition who were admitted to the Médecins sans Frontières malnutrition treatment programme in Maradi, Niger during 2006 (n=56,214). Differences in the number of children eligible for admission in therapeutic feeding programmes using the NCHS reference vs. the WHO standards were compared. Eligibility for admission was defined using the weight-for-height (WFH) < -3 Z score and WFH < 70% of the median criteria.

Results Using the Z score criterion, the number of children identified as eligible for admission was over four times larger with the use of the WHO standards, compared with the NCHS reference. Children included with the WHO standards were younger and had higher WHF Z scores on admission than those included with the NCHS reference. Three percent of children (154 / 6,115) who were eligible for nutritional assistance according to the NCHS reference and Z score criterion would be excluded with the use of WHO standards and Z score criterion. Those excluded were almost entirely between the ages of 13 to 24 months and had higher WFH Z scores on admission.

Using the percent of the median criterion, over 60% of children identified as eligible for admission by the NCHS reference (2,007 / 2,978) were also identified by the WHO standards. Introduction of the WHO standards identified an additional 18% of children not identified by the NCHS reference (528 / 2,978) and excluded over 30% of children previously identified by the NCHS reference (971 / 2,978). Compared with children eligible for admission by the NCHS reference, those children newly included with the WHO standards tended to be between the ages of 6 and 12 months and had significantly higher WFH Z scores on admission. Those excluded were largely between the ages of 13 to 24 months and had higher WFH Z scores on admission.

Finally, eight times more children (n=25,754) were identified as eligible for admission according to the WHO standards and WFH < -3 Z score criterion, compared with the NCHS reference and WFH < 70% of the median criterion (n=2,989). Children included with the WHO standards but not with the NCHS reference were again younger and had higher WHF Z scores on admission than

those included with the NCHS reference. No child who was eligible for nutritional assistance according to the NCHS reference and percent of the median criterion was excluded with the use of WHO standards and Z score criterion.

Conclusions The impact of the introduction of the WHO standards on the number of children eligible for admission in therapeutic feeding programmes will depend on the criterion for admission used. Use of the WHO standards with the Z score criterion to identify children for admission into therapeutic feeding programmes would imply a substantial increase in the number of children eligible for admission, with children included tending to be younger and have higher WFH on admission.

Update of WHO on the introduction on the WHO growth standards at country level. *A Onyango, World Health Organisation*

The WHO growth standards were released in 2006, and are already in use to some degree in many countries.

The decision to adopt the new standards depends largely on political, biological and economic/programmatic factors. Countries, especially those who have already developed their own growth reference system, must decide whether to keep them or to move to the international standards. No single indicator catches all of the potential growth problems of the individual child, so many countries are looking at the new standards to reflect overall status, using multiple indicators. Ultimately, the decision of whether or not to adopt the WHO standards is an individual choice for each country. Some are adopting a phased implementation plan, for example, starting with one indicator and working towards the inclusion of others to thus address their child nutrition problems comprehensively.

Overall, the new standards have been seen as an opportunity to redefine and revitalize actions to promote child growth and development. Currently, 75 countries have officially adopted, or are already using the new WHO growth standards and another 60 countries are in the process. Many have integrated height as a measure to be taken for assessing stunting and to enable the monitoring of overweight and obesity. The WHO Growth Standards are also being used for Demographic and Health Surveys (DHS) and Multiple Indicators Cluster Surveys (MICS) and by some of the UN partner agencies. They have also been made available to the general public and are being used on a case-by-case basis by parents, clinicians, lactation managers and many researchers.