

# Impact of the shift from NCHS growth reference to WHO<sub>2006</sub> growth standards in a therapeutic feeding programme in Niger

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## Summary

**OBJECTIVES** To describe the implementation of the WHO<sub>2006</sub> growth standards in a therapeutic feeding programme.

**METHODS** Using programme monitoring data from 21 769 children 6–59 months admitted to the Médecins Sans Frontières therapeutic feeding programme during 2007, we compared characteristics at admission, type of care and outcomes for children admitted before and after the shift to the WHO<sub>2006</sub> standards. Admission criteria were bipedal oedema, MUAC <110 mm, or weight-for-height (WFH) of <-70% of the median (NCHS) before mid-May 2007, and WFH <-3 *z* score (WHO<sub>2006</sub>) after mid-May 2007.

**RESULTS** Children admitted with the WHO<sub>2006</sub> standards were more likely to be younger, with a higher proportion of males, and less malnourished (mean WFH -3.6 *z* score *vs.* mean WFH -4.6 *z* score). They were less likely to require hospitalization or intensive care (28.4% *vs.* 77%; 12.8% *vs.* 36.5%) and more likely to be treated exclusively on an outpatient basis (71.6% *vs.* 23%). Finally, they experienced better outcomes (cure rate: 89% *vs.* 71.7%, death rate: 2.7% *vs.* 6.4%, default rate: 6.7% *vs.* 12.3%).

**CONCLUSIONS** In this programme, the WHO<sub>2006</sub> standards identify a larger number of malnourished children at an earlier stage of disease facilitating their treatment success.

**keywords** nutrition, weight-for-height *z* score, malnourishment, children, Niger, WHO<sub>2006</sub> standards

## Introduction

Early childhood malnutrition is common in large areas of South Asia and Sub-Saharan Africa, where 40% of children under five are stunted and prevalence of wasting is often over 10% (UNICEF 2006). The region of Maradi, in the southern part of Niger, is one of the highest burden malnutrition areas in the world, with up to 60% of children under five who are stunted and an all cause under five mortality rate of 231 per 1000 (INS Niger 2007). Each year, thousands of severely malnourished children are admitted to therapeutic feeding centres.

Médecins Sans Frontières (MSF) has been involved in a large programme for the treatment of malnutrition since 2001. Over this time, MSF progressively increased programme capacity and geographic coverage through the implementation of a community-based approach (Collins *et al.* 2006; WHO 2007) and the use of a nutrient-dense ready-to-use therapeutic food (RUTF) (Briend *et al.* 1999).

In therapeutic feeding programmes, children are admitted according to their nutritional status, assessed by growth

references. In April 2006, WHO released new growth standards (WHO<sub>2006</sub> standards) (de Onis *et al.* 2004; WHO 2006). Recent studies highlight the benefit of using the WHO<sub>2006</sub> standards as an effective tool for admission to treatment at early stages of malnutrition (Dale *et al.* 2009; Isanaka *et al.* 2009). However, the shift to the WHO<sub>2006</sub> standards presents a challenge as studies comparing the WHO<sub>2006</sub> standards and the formerly recommended NCHS reference at the same cut-off showed at least a twofold increases in the prevalence of acute wasting with the WHO<sub>2006</sub> standards (de Onis *et al.* 2006; Seal & Kerak 2007).

In May 2007, MSF shifted to WHO<sub>2006</sub> standards for admission of severely malnourished children in its programme in Maradi. The MSF strategy in Niger combined: (1) the use of more sensitive admission criteria (WHO<sub>2006</sub> standards); and (2) prevention through a large-scale monthly distribution of a new ready-to-use food (RUF) (Plumpy'doz<sup>®</sup>, Nutriset, Malaunay, France), to all children 6- to 36-months old from Guidan Roundji district, during the hunger gap, from May to October (Defourny *et al.*

2009). This study aims to assess the effect of the shift to the WHO<sub>2006</sub> growth standards as part of the 2007 MSF strategy.

## Methods

### MSF feeding programme

The MSF therapeutic feeding programme in 2007 was composed of eight outpatient units, attached to integrated health centres and one inpatient centre with a capacity of up to 300 children (Figure 1). Malnourished children with a severe pathology, anorexia or major oedema were considered complicated and admitted directly to the inpatient centre. Patients requiring close follow-up from trained nurses and doctors or requiring specialized medical care were hospitalized in the intensive care unit of the inpatient centre. All non-complicated cases were admitted directly into an outpatient unit and were referred to the inpatient centre only if they developed complications or did not respond to treatment. Two packets of RUTF (Plumpy'nut<sup>®</sup>, Nutriset, Malaunay, France) (1000 kcal/day) were used as the treatment for all outpatients.

### Data analysis

At admission, children were assessed for malnutrition, using weight, height (or length for children <85 cm), MUAC and presence of oedema. Measurements were taken in accordance with WHO standard techniques. Children were eligible for admission with at least one of the following criteria: bipedal oedema, a MUAC less than 110 mm (for children more than 65 cm), or weight-

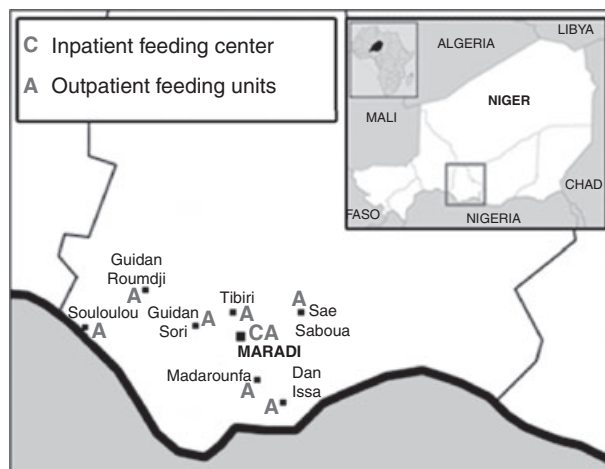
for-height ratio (WFH) of <70% of the median (NCHS reference) before mid-May 2007, and WFH <-3 *z* score (WHO<sub>2006</sub> standards) after mid-May 2007. Discharge occurred at WFH greater than 80% of the median after two consecutive weightings, before mid-May 2007; and at WFH greater than -2 *z* score, after mid-May 2007.

Combined-sex tables were used to classify children admitted by the NCHS reference, while sex-specific charts had been produced for the WHO<sub>2006</sub> standards. Despite the gradual implementation of the WHO<sub>2006</sub> standards during the month of May, for data analysis we consider the shift to occur on 15 May.

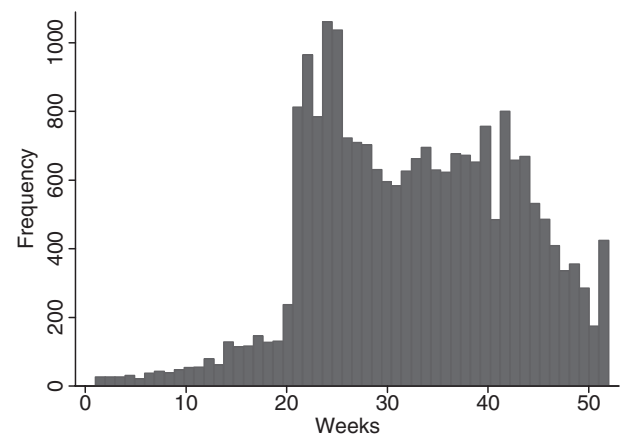
We use programme monitoring data from all children 6–59 months admitted to treatment in the MSF therapeutic feeding programme from 1 January to 31 December 2007. Information was gathered from the medical records of discharged children from the therapeutic feeding programme and entered weekly. Statistical analyses were performed using STATA software (Version 10; STATA Corporation, TX, USA). Categorical variables were compared with  $\chi^2$  tests and continuous variables with *t*-tests after testing for normality. *P* values <0.05 were considered statistically significant.

## Results

In 2007, 21 769 severely malnourished children aged 6–59 months were admitted. Of these, 1349 (6.2%) were admitted before May 15, using the NCHS reference; 20 420 children (93.8%) were admitted after, when WFH <-3 *z* score (WHO<sub>2006</sub> standards) replaced the NCHS criteria of WFH <70%. Figure 2 shows the dramatic increase of admissions after the shift to the WHO<sub>2006</sub> standards.



**Figure 1** Map of locations of MSF inpatient centre and outpatient units in Maradi, Niger 2007.



**Figure 2** Weekly admission of severe acute malnourished children in Maradi, Niger 2007.

A. Minetti *et al.* **Shift to WHO<sub>2006</sub> growth standards****Table 1** Characteristics of children with severe acute malnutrition according to the growth reference used for admission (NCHS reference or WHO standards), in Maradi, Niger 2007

	Overall	Admitted before 15 May (NCHS Ref.)	Admitted after 15 May (WHO Stnds.)	<i>P</i> value
<i>n</i>	21 769	1349	20 420	
Mean weekly admissions		70.5	618.8	
<i>Demographic characteristics</i>				
Mean age ± SD (months)	16.2 ± 8.0	17.3 ± 9.6	16.1 ± 7.9	<0.0001
<i>Sex</i>				
Male	54.9 (11958)	47.1 (634)	55.5 (11 324)	<0.0001
Female	45.1 (9806)	52.9 (712)	44.5 (9094)	<0.0001
<i>Admission criteria</i>				
By oedema	3.3 (704)	10.6 (141)	2.8 (563)	<0.0001
By MUAC	32.9 (7127)	56.2 (744)	31.4 (6383)	<0.0001
By W/H	63.8 (13831)	33.2 (440)	65.8 (13391)	<0.0001
<i>Nutritional status on admission</i>				
Mean NCHS W/H % median	73.2 ± 5.1	67.1 ± 5.6	73.6 ± 4.8	<0.0001
Mean WHO W/H <i>z</i> score	-3.7 ± 0.7	-4.6 ± 0.9	-3.6 ± 0.7	<0.0001
<i>Site of admission</i>				
Outpatient unit	81.3 (17 705)	32.4 (437)	84.6 (17 268)	<0.0001
Inpatient centre	18.7 (4064)	67.6 (912)	15.4 (3152)	<0.0001

Children admitted under the WHO<sub>2006</sub> standards were slightly younger (Table 1). The sex ratio of children was inverted before and after the shift, with a higher proportion of males admitted after 15 May. The relative proportion of children admitted by a criterion of WFH doubled with the WHO<sub>2006</sub> standards. Consequently, only 2.8% of children were admitted by oedema ( $n = 563$ ) and 31.4% ( $n = 6383$ ) were admitted with a MUAC <110 mm. When the NCHS reference was in use, 10.6% of children ( $n = 141$ ) were admitted with oedema and 56.2% ( $n = 744$ ) were admitted with a MUAC <110 mm.

Severely wasted children according to the WHO<sub>2006</sub> standards were admitted with a significantly higher mean WFH ratio, a mean WFH of -3.6 *z* score (or 73.6% of the

median with NCHS); while the mean WFH of children admitted by the NCHS reference was -4.6 *z* score (or 67.1% of the median with NCHS). Moreover, 84.6% of children admitted after mid-May were admitted directly in an outpatient unit, while most of children admitted before mid-May (67.6%) were orientated towards hospitalization (Table 1).

In terms of the type of care received and response to treatment, differences before and after the shift are also important (Table 2). With the NCHS reference, 23% ( $n = 310$ ) of children were admitted directly into outpatient units and only received outpatient care. A total of 369 children (27.3%) were admitted directly into an inpatient centre and remained hospitalized until discharge.

**Table 2** Treatment response by growth reference used for admission (NCHS reference or WHO standards), in Maradi, Niger 2007

	Overall	Admitted before 15 May (NCHS Ref.)	Admitted after 15 May (WHO Stnds.)	<i>P</i> value
<i>n</i>	21 769	1349	20 420	
<i>Type of care</i>				
Outpatient only	68.6 (14 928)	23.0 (310)	71.6 (14 618)	<0.0001
Inpatient only	6.9 (1502)	27.3 (369)	5.5 (1133)	<0.0001
Requiring ICU	14.2 (3100)	36.5 (493)	12.8 (2607)	<0.0001
<i>Outcome</i>				
Cured	87.9 (18 751)	71.7 (913)	89.0 (17 838)	<0.0001
Died	2.9 (621)	6.4 (82)	2.7 (539)	<0.0001
Default	7.0 (1502)	12.3 (157)	6.7 (1345)	<0.0001
Non-respondent	1.5 (319)	6.3 (80)	1.2 (239)	<0.0001
Weight gain (g/kg/day)	5.9 ± 5.8	7.4 ± 8.1	5.8 ± 5.7	<0.0001
Length of stay (days)	44.3 ± 31.2	54.9 ± 41.7	43.5 ± 30.1	<0.0001

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The remaining children (49.7%,  $n = 670$ ) received both outpatient and inpatient care. 493 children required intensive care (36.5%). 71.6% ( $n = 14618$ ) of children included through the WHO<sub>2006</sub> standards were admitted directly into the outpatient units and only received outpatient care. A total of 1133 children (5.5%) were admitted directly into an inpatient centre and remained hospitalized until discharge, and the remaining children (22.9%,  $n = 4669$ ) received both outpatient and inpatient care. Only 12.8% ( $n = 2607$ ) of children required intensive care.

Among children admitted by NCHS reference, the cure rate was 71.7%, the death rate was 6.4% and the default rate was 12.3%; the mean length of stay was 54.9 days and the mean weight gain 7.4 g/kg/day. Better outcomes were recorded among children admitted by WHO<sub>2006</sub> standards: the cure rate was 89%, the death rate was 2.7% and the default rate was 6.7%; mean length of stay and mean weight gain were lower (43.5 days and 5.8 g/kg/day).

### Discussion

Previous studies have discussed the operational implications of classifying malnourished children according to the WHO<sub>2006</sub> standards (Deshmukh *et al.* 2007; Seal & Kerak 2007). Here, we described the implementation of the WHO<sub>2006</sub> standards in a therapeutic feeding programme. The results of this study confirm that the WHO<sub>2006</sub> standards classify more children as severely wasted compared to the NCHS reference (de Onis *et al.* 2006; Onyango *et al.* 2007; Seal & Kerak 2007), with a dramatic impact on the size of the programme. However, we observed that children selected with the WHO<sub>2006</sub> standards were admitted at an earlier stage of disease, as highlighted by previous findings (Isanaka *et al.* 2009). Moreover, they were more likely to be treated exclusively on an outpatient basis; and they experienced better outcomes.

Complicated cases of malnutrition, requiring hospitalization and trained medical staff, still limit programme capacity and quality. The use of the WHO<sub>2006</sub> standards for admission helps to select malnourished children before they become complicated cases, thus reducing the need of qualified nurses and doctors and specialized inpatient wards. The WHO<sub>2006</sub> standards are a more inclusive tool to identify children before they are too sick to be treated easily and effectively.

There are two key limitations to this study. First, differences in characteristics on admission and in outcomes before and after the shift to the new standards may also depend by seasonal patterns of disease (e.g. malaria, highly prevalent between June and September). However, differences observed are so wide that we do not expect this to change our conclusions. Second, children admitted into the

programme through the NCHS reference were classified using combined-sex charts while children admitted through the WHO<sub>2006</sub> standards were classified using sex-specific tables. This resulted in having slightly more girls admitted to the programme with the NCHS reference than would have been expected with sex-specific charts and can explain the change in sex ratio with the shift to the WHO<sub>2006</sub> standards.

Results presented here suggest that a more preventative model of treatment, combining a large-scale prevention of nutritional deficiencies with the early treatment of wasted children, can be more effective than current practices. This shift would require organizations to increase their treatment capacity, particularly in their outpatient units. However, despite the expected increase in workload, shifting to the WHO<sub>2006</sub> standards is possible, feasible and helps to prevent severity and death.

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