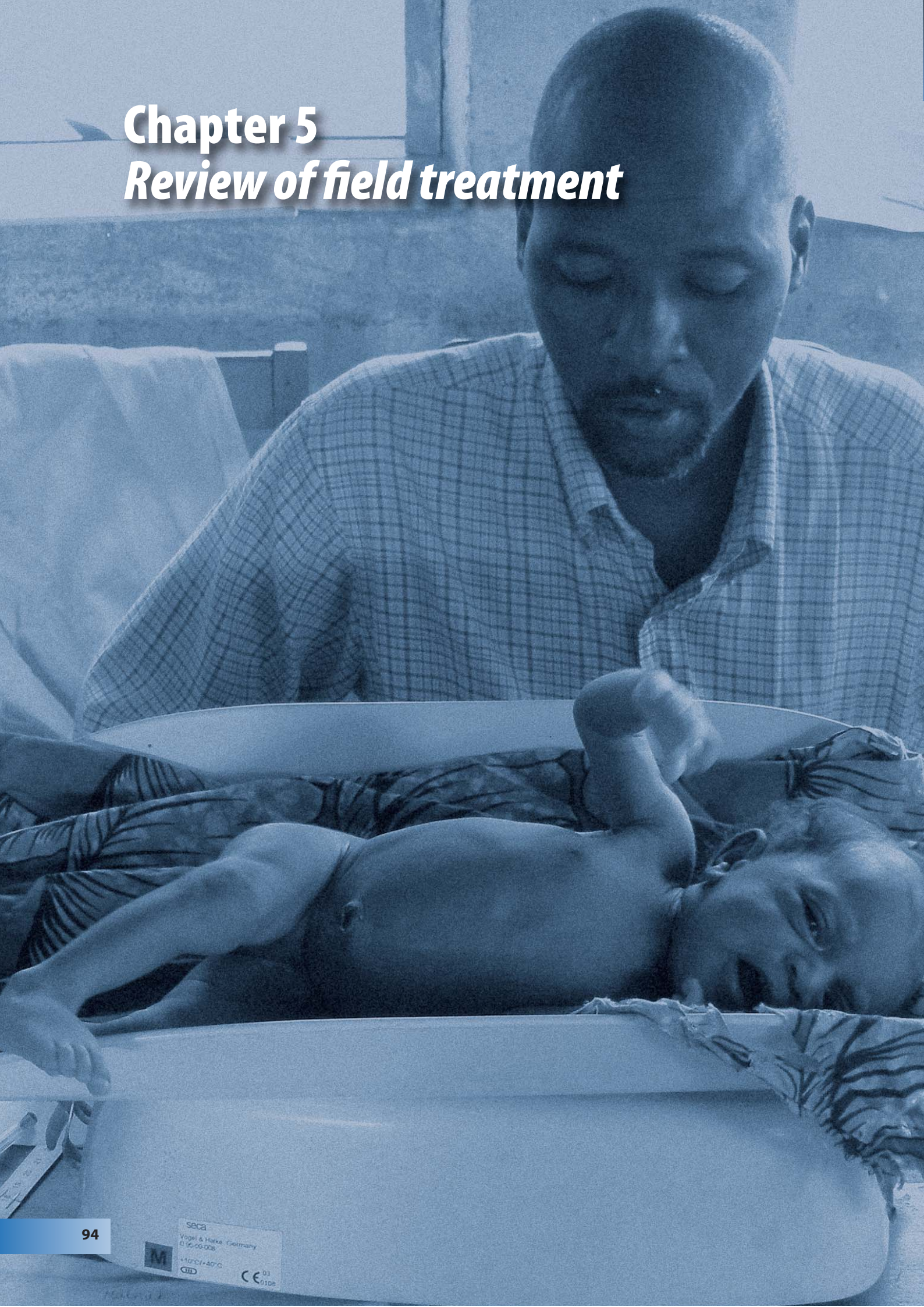
Chapter 5
Review of field treatment



Chapter 5: Review of field treatment

5.1 Rationale for field data analysis

Describing infant <6m patient profile and outcomes associated with current management is central to the MAMI Project. From analysis of field data, hypotheses can be generated, and where possible, inferences made about the effectiveness of current management strategies. This chapter presents data on infants <6m gathered from therapeutic feeding programmes (TFPs) and supplementary feeding programmes (SFPs), with a particular emphasis on individual level data. This is complemented by qualitative 'key informant' data in Chapter 6.

5.2 Aims

To analyse available TFP and SFP databases to determine:

- % of current feeding programme admissions that are infants <6m
- anthropometric and clinical profile of malnourished infants <6m
- outcomes from current programmes, that use current management guidelines, for infants <6m.

5.3 Methods

5.3.1 Identifying field data

An open invitation was given to share databases of programmes targeting acute malnutrition in infants <6m and contacts were actively pursued from May 2008 to December 2008. This generated two types of database:

a) Raw databases with individual-level data on each patient admitted for treatment
A total of 33 datasets with information on individual children and infants <6m were obtained. These were mostly from Action Contre la Faim (ACF), from 12 countries, with a total of 118,180 individuals aged 0 to 59 months. Data was available in Excel format which had been previously entered in the field, and further sorted and cleaned at organizational headquarter level. For 11 countries, a detailed description of the datasets received, grouped by country of origin, was provided. The number of individuals aged 0- 59m included in each dataset ranged from 59 to 22,473 with an average of 3,812 per dataset. This data is the main focus of the chapter.

b) Summary databases reporting overall programme outcomes by age category
Two different sources of compiled data were made available to the MAMI Project. First, routine databases compiled by MSF of various non-contiguous dates, spanning between July 2003 and December 2008, of seven programmes located in Sierra Leone (two programmes), Niger (four programmes) and Somalia (one programme). Secondly, a dataset of compiled data from 15 programmes in Burundi from various organizations, covering the period September 2001 to December 2002. These compiled data were used to assess the difference in mortality as an outcome between infants <6m and children.

5.3.2 Cleaning & processing field data

In all datasets, complete data was available for most individuals only at admission and discharge. Data from multiple follow-ups were also available, but there was large heterogeneity of values, so these were not included. Data at admission included date, age, weight, length/height, MUAC and the presence of oedema. Data at discharge included date, weight, height and MUAC and outcome. Since our main aim was to evaluate the disease burden and outcomes, only variables at admission and outcomes were selected.

All variables at admission and discharge were cleaned and coded for analysis. Data were checked for errors which may have occurred during data entry or database merging. Data cleaning was done twice by the same person, each at different times. Agreement in data cleaning results was assessed and when differences arose, corrected. Data were recoded to simplify the large number of initial outcomes described by field programmes.

Table 11: Description of the 'raw' databases of children 0-59m received for analysis by country

Country	Organisation	Year	Sites	Type of care	N	No. of datasets
Afghanistan	ACF	2002-04	Kabul	TFC, DC, SC	1,096	1
Burundi	ACF	2006-07	Buye Gikomero Kabarore Kayanza Kinini Matongo Mubuga Muhanga Musema Ngozi Rukago Ruyigi	CJ, PTA	5,481	3
Ethiopia	MSF	2006-08	Kuyera	SC	59	1
Kenya	ACF	2005-07	Banisa Malkamari Mandera Takaba	TFC, OTP, SFC	8,466	4
Liberia	ACF	2006-08	Monrovia	TFC	2,797	1
Myanmar	ACF	2006-08	Buthidaung Moungdaw	SC, HT, OTP	2,011	2
Niger	ACF	2006-08	Abalak Keita Mayahi	CRENAS, CRENI	7,110	2
DRC	ACF	2005-07	Baraka Buta Baraka Dubie Kilembwe Malemba Mitwaba Sampwe Uvira	CNT, CNS, HT	24,155	6
Somalia	ACF	2005-07	Baraka Buta Baraka Dubie Kilembwe Malemba Mitwaba Sampwe Uvira	CNT, CNS, HT	24,155	6
Somalia	ACF	2005-08	Mogadishu Wajid	TFC, OTP, SC	8,355	4
Sudan	ACF	2005-08	Nyala El Fasher Kalma Bentiu	TFC, OTP, SC	8,355	4
Tajikistan	ACF	2005-06	Kulyab Kurgan Tyube	SFC, TFC	9,329	2
Uganda	ACF	2005-07	Amuru Apac Gulu Lira Oyam	SFC, TFC, TFP, CBC	45,591	5
Total					118,180	33

DRC: Democratic Republic of the Congo;
ACF: Action Contre la Faim;
MSF: Médecins Sans Frontières;
CBC: Community-based Care;
CJ: Centre du Jour;
CNS: Centre de Nutrition Supplémentaire;
CNT: Centre de Nutrition Thérapeutique;
CRENAS: Centre de Récupération Nutritionnelle Ambulatoire pour Sévères;
CRENI: Centre de Récupération Nutritionnelle en Interne;
DC: Day Centre;
HT: Home treatment;
OTP: Out-Patient Therapy; PTA: Programme Thérapeutique Ambulatoire;
SC: Stabilisation centre;
SFC: Supplementary Feeding Centre;
TFC: Therapeutic Feeding Centre;
TFP: Therapeutic Feeding Program

Table 12: Details of the data cleaning results

	Action taken		
Variable with errors/Type of error	Deleted	Corrected*	Missing values
Double data entry/duplicates	1,389		
Age at admission	19	128	93
Admission date	6	1	
Admission weight	57	1,606	608
Admission height	160	1,047	874
Admission MUAC		2,067	13,001
Discharge date	3	1	1,919
Discharge weight	40	1,421	3,029
Discharge height	94	919	3,855
Discharge MUAC	413	2,010	12,223
Total	2,181	9,200	35,602

* See the body of the text for an explanation of the types of errors corrected.

Data cleaning

Table 12 details the distribution of errors in all variables and whether the error was deleted or corrected. From a total of 118,180, 1,389 (1.2%) individuals were found duplicated in the datasets and eliminated. All duplicates came from the same dataset. A total of 11,381 errors were found that were either corrected (80.8%) or deleted (19.2%). The large majority of errors were clustered around anthropometric measurements (9,834 or 86.4%), MUAC data being the most predominant source of error (35.8%). Common errors were incorrect use of punctuation (e.g.: 12...5, 12:5, etc.) or the combination of text and number (e.g.: 4mo, 2y4m, etc.). Additionally, missing values in the dataset (usually anthropometric measurements) were more common at discharge than at admission. MUAC at admission and discharge accounted for the greatest proportion of missing values (70.8%). These missing MUAC measurement reflect two issues:

- MUAC is not currently recommended for infants <6m so was less commonly measured in this age group
- MUAC has only been gaining widespread acceptance in the last few years; at the time these datasets were collected the main focus / admission criterion was weight-for-height.

Data coding

Three variables were coded to reduce variability and cluster similar groups, and so facilitate analysis:

a) Programme type

The type of programme was indicated in the dataset by either a separate variable or as the title of the dataset. Table 13 provides detail of the original coding provided for each programme and the new code for MAMI Project analysis. Re-coding reduced the number of categories from 14 to seven. The number of individuals included in each category is detailed in Table 13. The majority of individuals (62.9%) were admitted in Supplementary Feeding Centres (SFC), followed by Therapeutic Feeding Centres (TFC) and Out-Patient Therapy Programmes (OTP). We could not determine the type of programme for 1,020 (0.9%) enrolled individuals.

b) Age group

Individuals were classified according to their age in six categories based on the criteria defined in Table 15. Of the total of 116,791, 0.1% had missing data on age and 12.9% were classified as having an age at admission greater than 60 months. Since there was evidence of rounding up of age to 60 months, children at 60 months (n=2712) were included in some of the analysis as a separate group.

c) Discharge outcome

A total of 101 different codes were used to classify the discharge outcome. Of these 101 codes, only 31 were used in more than one country (Table 43 in Appendix C). Cured, defaulter, admission mistake, death and transfer were the outcomes more commonly used. Overall, countries varied widely in the number of discharge outcome codes used, ranging from six to 48 different codes.

The original discharge outcomes codes were grouped into Sphere-compatible discharge codes as detailed in Table 13. Where the final outcome was unclear and coded only as 'end of follow-up' discharge codes were re-coded as 'cured' if their WHM was ≥ 80% or as 'non-recovery' if it was < 80%.[145]

Table 13: Programme type coding

Original*	Meaning	New	Meaning
CBC	Community-based Care	**CBC**	Community-based Care
CJ	Centre du Jour	**DC**	Day Centre
DC	Day Centre	**DC**	Day Centre
HT	Home treatment	**HT**	Home Treatment
CRENAS	Centre de Récupération Nutritionnelle Ambulatoire pour Sévères	**OTP**	Out-Patient Therapy
CS	Centre de Récupération Nutritionnelle Ambulatoire pour Sévères	**OTP**	Out-Patient Therapy
OTP	Out-Patient Therapy	**OTP**	Out-Patient Therapy
PTA	Programme Thérapeutique Ambulatoire	**OTP**	Out-Patient Therapy
SC	Stabilisation centre	**SC**	Stabilisation centre
SC & HT	Stabilisation centre - Home treatment	**SC**	Stabilisation centre
CNS	Centre de Nutrition Supplémentaire	**SFC**	Supplementary Feeding Centre
SFC	Supplementary Feeding Centre	**SFC**	Supplementary Feeding Centre
CI	Centre de Récupération Nutritionnelle en Interne	**TFC**	Therapeutic Feeding Centre
CNT	Centre de Nutrition Thérapeutique	**TFC**	Therapeutic Feeding Centre
CRENI	Centre de Récupération Nutritionnelle en Interne	**TFC**	Therapeutic Feeding Centre
TFC	Therapeutic Feeding Centre	**TFC**	Therapeutic Feeding Centre
TFC/DC/HT	Therapeutic Feeding Centre	**TFC**	Therapeutic Feeding Centre
TFC-HT	Therapeutic Feeding Centre	**TFC**	Therapeutic Feeding Centre
TFP	Therapeutic Feeding Program	**TFP**	Therapeutic Feeding Programme

* As it appears in the original datasets.

Table 14: Number of individuals enrolled in different types of programme

Programme type	N	%
CBC	1,091	0.93
DC	3,365	2.88
HT	1,311	1.12
OTP	11,916	10.20
SC	505	0.43
SFC	74,342	63.65
TFC	23,241	19.90
Missing	1,020	0.87
Total*	**116,791**	

CBC: Community-based Care;
DC: Day Centre;
HT: Home treatment;
OTP: Out-Patient Therapy;
SC: Stabilisation centre;
SFC: Supplementary Feeding Centre;
TFC: Therapeutic Feeding Centre.

*1,389 records were excluded as duplicates

Table 15: Definition of age categories & frequency

Age group	N	%	Definition
Missing	112	0.10	Age data at admission missing
<6 months	5,033	4.31	Age at admission <6 months
6 to 59 months	93,929	80.42	Age at admission ≥6 months but <60 months
60 months	2,712	2.32	Age at admission = 60 months
Confirmed >60 months*	7,720	6.61	A combination of at least two values. Age at admission >60 months, weight at admission >33 kg‡ and height at admission >130 cm‡
Not confirmed >60 months	7,285	6.24	Age at admission >60 months
Total	**116,791**		

* An individual with and age value <60 months but with a combination of weight and height at admission greater that 33 kg and 130 cm respectively was considered as older than 60 months. ‡ These values correspond to approximately 6 and 4.4 z-scores for weight and height for age respectively for a 60 months old male and 5.5 and 4.9 z-scores for a 60 months old female.

Table 16: Re-coding of original discharge codes into a Sphere-compatible code

	Sphere discharge code						
Original discharge code*	Admission error	New Defaulter	Died	Cured	Non-recovery	Missing	Total
End of CBC follow up‡				+	+		86
End of TFC‡				+	+		90
End of TFC follow up‡				+	+		2,090
End of follow up‡				+	+		711
End of transit‡				+	+		5
Fin suivi CNT‡				+	+		2,660
C				+			902
Cured				+			50,483
End OTP				+			1
End of CBC				+			3
End of OTP follow up				+			7
Guéri				+			23,921
Dead			+				294
Death			+				691
Décédé			+				35
Died			+				14
Décès			+				710
M			+				13
Autres				+			72
C.N.R				+			276
CNR				+			613
Criteria not reached							23
Critères non-atteints				+			163
D/Regestration				+			9
DNG				+			45
Inconnu				+			44
Medical referal				+			1
Medical transfer				+			201
NR				+			51
Non guéri				+			47
Non répondant				+			1,645
Non respond				+			5
Non respondant				+			362
Non respondant				+			9,355
Non response				+			317
OTP transfer				+			1
Other				+			545
Others				+			15
R,Creni				+			10
R,Transfert				+			68
Refus Creni				+			6
Refus de transfert				+			2
Refus transfert				+			5
Refused to go TFC				+			1
SFC transfer				+			2
T				+			43
T, Creni				+			21
TFC				+			20
To other OTP				+			1
Transfer				+			863
Transfer CTC / TFC				+			12

Table 16 cont'd

	Sphere discharge code						
Original discharge code*	Admission error	New Defaulter	Died	Cured	Non-recovery	Missing	Total
Transfer HP				+			139
Transfer SFC				+			46
Transfer TFC				+			26
Transfer other				+			3
Transfer others				+			6
Transfer to CBC				+			101
Transfer to CTC				+			32
Transfer to Health Ce				+			1
Transfer to OPT				+			3
Transfer to OTP				+			59
Transfer to OTP / TFC				+			414
Transfer to SFC				+			249
Transfer to TFC				+			786
Transfer to other CTC				+			5
Transfer to other OTP				+			5
Transfer to other SFC				+			965
Transfert				+			584
Transfert CNS				+			1,494
Transfert CNT				+			619
Transfert CS				+			4
Transfert Centre de S				+			1
Transfert H				+			1
Transfert hôpital				+			161
Transfert medical				+			33
Transfert vers crenam				+			9
Transfert vers creni				+			31
Transféré				+			31
Transit				+			2
Unknown				+			8
Wrong discharge				+			31
non responder				+			136
Abandon		+					2,061
D		+					104
Def		+					1
Default		+					76
Defaulter		+					8,531
AM	+						5
Admission error	+						1
Admission mistake	+						449
CH	+						45
Cheating	+						36
Erreur admission	+						7
Erreur d'admission	+						283
Error	+						4
Mistake	+						6
Mistake admission	+						2
Mistake of admission	+						3
Wrong admission	+						7
Wrong child	+						14
Missing value						+	1,611
Total	**862**	**10,773**	**1,757**	**80,174**	**21,614**	**1,611**	**116,791**

* As originally appear in the databases. ‡ End of follow-up were classified as either cured if weight for height at discharge was at least 80%, or non-recovery if it was less than 80%

5.4 Analysis

5.4.1 Data selection for analysis

From an original dataset of 118,180 individuals, we excluded all duplicate records, individuals >60m or with either age or sex missing (Figure 19) leaving a sample of 100,688 individuals aged >0 to 60 months. The distribution of infants <6m, children 6 to 59m and 60m for each programme type are described in Table 17. As expected, programmes providing CBC, OTP and SFC care have none or very few infants in their datasets (0, 0.21 and 1.52% respectively). Data from these three groups were excluded from the analysis of infant acute malnutrition (Figure 18). DC, HT, SC and TFC care presented 24.67%, 9.97%, 23.91% and 14.78% of infants <6m respectively. The final sample for analysis of acute malnutrition was 25,195 children aged 0 to 60 months.

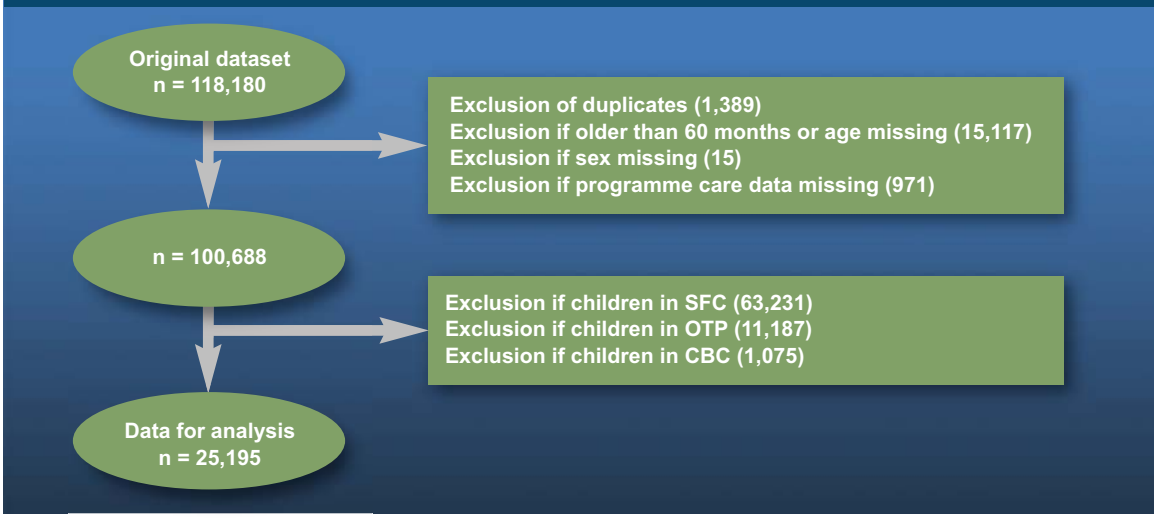
Table 17: Frequency distribution by age group and programme type

		Sphere discharge code			
Programme type		**<6 months**	**6 to 59 months**	**60 months**	**Total***
CBC	*n*		1,071	4	1,075
	%		99.63	0.37	100
DC	*n*	738	2,053	201	2,992
	%	24.67	68.62	6.72	100
HT	*n*	114	1,009	20	1,143
	%	9.97	88.28	1.75	100
OTP	*n*	24	11,047	116	11,187
	%	0.21	98.75	1.04	100
SC	*n*	99	306	9	414
	%	23.91	73.91	2.17	100
SFC	*n*	963	60,213	2,055	63,231
	%	1.52	95.23	3.25	100
TFC	*n*	3,051	17,299	296	20,646
	%	14.78	83.79	1.43	100
Total	***n***	**4,989**	**92,998**	**2,701**	**100,688**
	%	**4.95**	**92.36**	**2.68**	**100**

CBC: Community-based Care;
CJ: Centre du Jour;
DC: Day Centre;
HT: Home treatment;
OTP: Out-Patient Therapy;
SC: Stabilisation centre;
SFC: Supplementary Feeding Centre;
TFC: Therapeutic Feeding Centre.

* As originally appear in the databases. ‡ End of follow-up were classified as either cured if weight for height at discharge was at least 80%, or non-recovery if it was less than 80%

Figure 18: Flow diagram of data selection for analysis



5.4.2 Data analysis

Simple comparisons were carried due to the nature and quality of the data. Meta-analysis was carried for comparison between infants <6m, children aged 6 to 59m and children=60m months for the presence of oedema and death as an outcome of the programme.

5.5 Results

5.5.1 Country and programme distribution

A total of 25,195 children, of whom 4,002 were infants <6m, were included in the MAMI Project analysis. The distribution of infants <6m and children according to the type of programme and country of origin are detailed in Table 18. The contribution to our final 0 to 60 month sample ranged, by country, from 57 (0.2%) from Ethiopia to 6,229 (24.7%) from DRC. Most of this sample of children were managed in TFCs (n = 20,646, 81.9%), and a minority in SCs (n = 414, 1.6%). A similar distribution pattern was observed for infants <6m

Table 18: Programme and country distribution of the final sample included for analysis* and the sub-sample of infants <6m

0 to 60 months	Type of programme				
Country	**DC**	**HT**	**SC**	**TFC**	**Total**
Afghanistan	633			460	**1,093**
Burundi	2,359				
Ethiopia			57		**57**
Kenya				539	**539**
Liberia				2,436	**2,436**
Myanmar		1,143	248		**1,391**
Niger				1,108	**1,108**
DRC				6,229	**6,229**
Somalia				2,997	**2,997**
Sudan			109	5,218	**5,327**
Tajikistan				373	**373**
Uganda				1,286	**1,286**
Total	**2,992**	**1,143**	**414**	**20,646**	**25,195**
0 to 60 months	**Type of programme**				
Country	**DC**	**HT**	**SC**	**TFC**	**Total**
Afghanistan	592			438	**1,030**
Burundi	146				**146**
Ethiopia			33		**33**
Kenya				37	**37**
Liberia				167	**167**
Myanmar		114	66		**180**
Niger				145	**145**
DRC				1,400	**1,400**
Somalia				402	**402**
Sudan				360	**360**
Tajikistan				86	**86**
Uganda				16	**16**
Total	**738**	**114**	**99**	**3,051**	**4,002**

DRC: Democratic Republic of the Congo
DC: Day Centre
HT: Home treatment
SC: Stabilisation centre
TFC: Therapeutic Feeding Centre

* 92,985 records were removed from the original 118,180 sample.

Table 19: Burden of disease. Age distribution by country and by programme, of the sample of children selected for analysis*

		Age group			
Country		**<6 months**	**6 to 59 months**	**60 months**	**Total**
Afghanistan	n	1,030	63		1,093
	%	*94.2*	*5.8*		*100.0*
Burundi	n	146	2,012	201	2,359
	%	*6.2*	*85.3*	*8.5*	*100.0*
Ethiopia	n	33	24		57
	%	*57.9*	*42.1*		*100.0*
Kenya	n	37	494	8	539
	%	*6.9*	*91.7*	*1.5*	*100.0*
Liberia	n	167	2,249	20	2,436
	%	*6.9*	*92.3*	*0.8*	*100.0*
Myanmar	n	180	1,189	22	1,391
	%	*12.9*	*85.5*	*1.6*	*100.0*
Niger	n	145	963		1,108
	%	*13.1*	*86.9*		*100.0*
DRC	n	1,400	4,634	195	6,229
	%	*22.5*	*74.4*	*3.1*	*100.0*
Somalia	n	402	2,563	32	2,997
	%	*13.4*	*85.5*	*1.1*	*100.0*
Sudan	n	360	4,928	39	5,327
	%	*6.8*	*92.5*	*0.7*	*100.0*
Tajikistan	n	86	287		373
	%	*23.1*	*76.9*		*100.0*
Uganda	n	16	1,261	9	1,286
	%	*1.2*	*98.1*	*0.7*	*100.0*
Total	**n**	**4,002**	**20,667**	**526**	**25,195**
	%	***15.9***	***82.0***	***2.1***	***100.0***
		Age group			
Country		**<6 months**	**6 to 59 months**	**60 months**	**Total**
DC	n	738	2,053	201	2,992
	%	*24.7*	*68.6*	*6.7*	*100.0*
HT	n	114	1,009	20	1,143
	%	*10.0*	*88.3*	*1.8*	*100.0*
SC	n	99	306	9	414
	%	*23.9*	*73.9*	*2.2*	*100.0*
TFC	n	3,051	17,299	296	20,646
	%	*14.8*	*83.8*	*1.4*	*100.0*
Total	**n**	**4,002**	**20,667**	**526**	**25,195**
	%	***15.9***	***82.0***	***2.1***	***100.0***

DRC: Democratic Republic of the Congo;
DC: Day Centre;
HT: Home treatment;
SC: Stabilisation centre;
TFC: Therapeutic Feeding Centre.

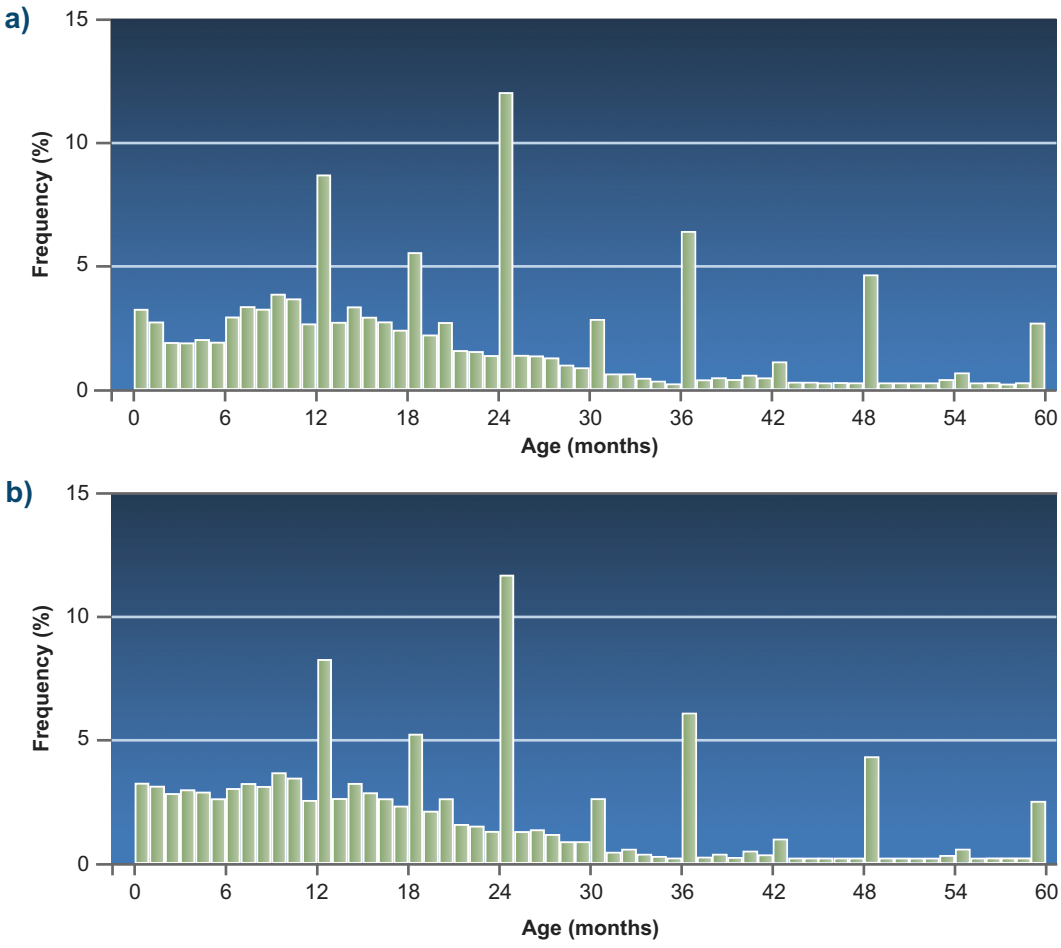
* 92,985 records were removed from the original 118,180 sample.

5.5.2 Burden of disease of infant <6m malnutrition: age distribution

Overall 15.9% of total admissions were infants <6m, with a wide range from 1.2% in Uganda to 37% in Kenya and 94.2% in Afghanistan. By programme type, infant <6m malnutrition ranges from 10% in HT care to 24.7% in DC care.

Acute malnutrition in infants <6m forms part of the 'normal' phenomenon of malnutrition early in life, as shown form the age distribution in Figure 19. The pattern remains, even after the exclusion of Afghanistan and Ethiopia datasets where data on infant <6m is concentrated. For children ≥12 months, the rounding of age to the nearest three and six months period was common, with rounding to the nearest six most common. The prevalence of admissions in children decreases with age, markedly after the age of 36 months.

Figure 19: Age frequency distribution at admission
a) Excluding data from Afghanistan and Ethiopia (n = 24,045)
b) Including data from Afghanistan and Ethiopia (n = 25,195)



Infants <6m were grouped by age as <2 months, 2 to 3.9 months and 4 to 5.9 months and the distribution was analysed by country and by programme type provided (Table 20). Overall infant malnutrition is evenly distributed across the age range in infants, between 36% (< 2 months) and 31% (4.5.9 months). However, there is great variation across countries and programmes. No clear or consistent pattern was evident.

Table 20: Age distribution by country and by programme type of the sample of infant selected for analysis*

		Age group			
Country		**< 2 months**	**2 to 3.9 months**	**4 to 5.9 months**	**Total**
Afghanistan	n	126	495	409	1,030
	%	*12.2*	*48.1*	*39.7*	*100.0*
Burundi	n	50	57	39	146
	%	*34.3*	*39.0*	*26.7*	*100.0*
Ethiopia	n	4	17	12	33
	%	*12.1*	*51.5*	*36.4*	*100.0*
Kenya	n	3	19	15	37
	%	*8.1*	*51.4*	*40.5*	*100.0*
Liberia	n	49	64	54	167
	%	*29.3*	*38.3*	*32.3*	*100.0*
Myanmar	n	91	73	16	180
	%	*50.6*	*40.6*	*8.9*	*100.0*
Niger	n	71	41	33	145
	%	*49.0*	*28.3*	*22.8*	*100.0*
DRC	n	832	305	263	1,400
	%	*59.4*	*21.8*	*18.8*	*100.0*
Somalia	n	5	121	276	402
	%	*1.2*	*30.1*	*68.7*	*100.0*
Sudan	n	189	93	78	360
	%	*52.5*	*25.8*	*21.7*	*100.0*
Tajikistan	n	9	29	48	86
	%	*10.5*	*33.7*	*55.8*	*100.0*
Uganda	n	2	10	4	16
	%	*12.5*	*62.5*	*25.0*	*100.0*
Total	**n**	**1,431**	**1,324**	**1,247**	**4,002**
	%	***35.8***	***33.1***	***31.2***	***100.0***
		Age group			
Programme type		**< 2 months**	**2 to 3.9 months**	**4 to 5.9 months**	**Total**
DC	n	138	338	262	738
	%	*18.7*	*45.8*	*35.5*	*100.0*
HT	n	65	42	7	114
	%	*57.0*	*36.8*	*6.1*	*100.0*
SC	n	30	48	21	99
	%	*30.3*	*48.5*	*21.2*	*100.0*
TFC	n	1198	896	957	3051
	%	*39.3*	*29.4*	*31.4*	*100.0*
Total	**n**	**1,431**	**1,324**	**1,247**	**4,002**
	%	***35.8***	***33.1***	***31.2***	***100.0***

DRC: Democratic Republic of the Congo
DC: Day Centre
HT: Home treatment
SC: Stabilisation centre
TFC: Therapeutic Feeding Centre

* 92,985 records were removed from the original 118,180 sample.

5.5.3. Burden of disease of infant <6m malnutrition: sex distribution

A slightly higher proportion of male than female infants <6m compared to older children were admitted for care (Table 21). Evaluation by country and programme type found a higher male:female ratio in infants <6m than in 6 to 59m group. No correlation was found between the sex ratio exhibited in infants <6m and older children. Grouping infants <6m by age (22) showed that overall the male:female ratio increased with age in infants. This pattern, however, was not consistent once frequency was analysed by country or programme type.

Table 21: Male to female ratio by age group, by country and by programme type

	Age groups								
	<6 months			6 to 59 months			60 months		
Country	**F**	**M**	**M:F**	**F**	**M**	**M:F**	**F**	**M**	**M:F**
Afghanistan	466	564	1.2	27	36	1.3			
Burundi	79	67	0.8	933	1,079	1.2	94	107	1.1
Ethiopia	18	15	0.8	18	6	0.3			
Kenya	17	20	1.2	218	276	1.3	5	3	0.6
Liberia	76	91	1.2	1,131	1,118	1.0	11	9	0.8
Myanmar	97	83	0.9	765	424	0.6	11	11	1.0
Niger	71	74	1.0	448	515	1.1			
DRC	720	680	0.9	2,234	2,400	1.1	88	107	1.2
Somalia	191	211	1.1	1,229	1,334	1.1	16	16	1.0
Sudan	160	200	1.3	2,458	2,470	1.0	23	16	0.7
Tajikistan	42	44	1.0	150	137	0.9			
Uganda	8	8	1.0	605	656	1.1	4	5	1.25
Total	**1,945**	**2,057**	**1.1**	**10,216**	**10,451**	**1.0**	**252**	**274**	**1.1**
	Age groups								
	<6 months			6 to 59 months			60 months		
Programme type	**F**	**M**	**M:F**	**F**	**M**	**M:F**	**F**	**M**	**M:F**
DC	356	382	1.1	950	1,103	1.2	94	107	1.1
HT	58	56	1.0	648	361	0.6	11	9	0.8
SC	57	42	0.7	196	110	0.6	4	5	1.3
TFC	1,474	1,577	1.1	8,422	8,877	1.1	143	153	1.1
Total	**1,945**	**2,057**	**1.1**	**10,216**	**10,451**	**1.0**	**252**	**274**	**1.1**

DRC: Democratic Republic of the Congo
DC: Day Centre
HT: Home treatment
SC: Stabilisation centre
TFC: Therapeutic Feeding Centre
M: Male
F: Female
M:F: Male to Female ratio

Table 22: Male to female ratio by age group, by country and by programme type for infants aged <6 months

	Age groups								
	< 2 months			2 to 3.9 months			4 to 5.9 months		
Country	**F**	**M**	**M:F**	**F**	**M**	**M:F**	**F**	**M**	**M:F**
Afghanistan	52	74	1.4	221	274	1.2	193	216	1.1
Burundi	23	27	1.2	36	21	0.6	20	19	1.0
Ethiopia	3	1	0.3	8	9	1.1	7	5	0.7
Kenya	2	1	0.5	7	12	1.7	8	7	0.9
Liberia	21	28	1.3	34	30	0.9	21	33	1.6
Myanmar	49	42	0.9	44	29	0.7	4	12	3.0
Niger	35	36	1.0	20	21	1.1	16	17	1.1
DRC	447	385	0.9	148	157	1.1	125	138	1.1
Somalia	2	3	1.5	60	61	1.0	129	147	1.1
Sudan	84	105	1.3	44	49	1.1	32	46	1.4
Tajikistan	4	5	1.3	18	11	0.6	20	28	1.4
Uganda	2	0	0.0	5	5	1.0	1	3	3.0
Total	**724**	**707**	**1.0**	**645**	**679**	**1.1**	**576**	**671**	**1.2**
	Age groups								
	< 2 months			2 to 3.9 months			4 to 5.9 months		
Programme type	**F**	**M**	**M:F**	**F**	**M**	**M:F**	**F**	**M**	**M:F**
DC	61	77	1.3	167	171	1.0	128	134	1.0
HT	33	32	1.0	23	19	0.8	2	5	2.5
SC	19	11	0.6	29	19	0.7	9	12	1.3
TFC	611	587	1.0	426	470	1.1	437	520	1.2
Total	**724**	**707**	**1.0**	**645**	**679**	**1.1**	**576**	**671**	**1.2**

DRC: Democratic Republic of the Congo
DC: Day Centre
HT: Home treatment
SC: Stabilisation centre
TFC: Therapeutic Feeding Centre
M: Male
F: Female
M:F: Male to Female ratio

5.5.4. Infant malnutrition profile: Oedema

The presence of oedema was more common in children than in infants <6m (Table, Table 44, Appendix B). This difference cannot be accounted for by a difference in the proportion of missing values, as these percentages are similar between different age groups.

Based on Table and Table 44 data, forest plots were used to assess the risk ratio of presenting with oedema for infants <6m when compared with their six to 59 months olds (20). The presence of oedema in infancy ranged from 0 to 8.3%, whereas the presence of oedema in children ranged from 2% to 66%. The overall risk ratio was 0.1 (0.08, 0.12, $p < 0.001$). There was evidence of heterogeneity of the data when analysed by country or by programme type ($p<0.01$ in both cases). When evaluated by programme, the risk of presenting oedema for infants <6m was lowest for infants admitted to DC care and greatest for those in HT care. The presence of oedema in infants <6m did not correlate to the presence of oedema in their older counterparts.

Table 23: Oedema frequency distribution among different age groups and programme types provided for the sample included for SAM analysis

	Oedema		No oedema		Missing values	
Age group	**n**	**%**	**n**	**%**	**n**	**%**
<6 months	140	3.5%	3,812	95.3%	50	1.2%
6 to 59 months	7,261	35.1%	13,077	63.3%	329	1.6%
60 months	317	60.3%	205	39.0%	4	0.8%
Total	**7718**	**30.6%**	**17,094**	**67.8%**	**383**	**1.5%**

5.5.5 Infant malnutrition profile: Anthropometry

The quality of anthropometric data was evaluated. The number of missing values was used as a proxy of the quality of anthropometric data procurement and its recording. Overall, infants <6m had a higher proportion of measurements missing or wrongly recorded (Table 24). No difference was seen for weight, but missing values for length were greater in infants <6m. This meant that more infants <6m had missing HAZ indicators. Conversely, data for MUAC in infants <6m, a measurement not routinely recommended for this age group, showed to be present in almost 40% of the sample. This measurement was mostly clustered in SC and TFC programmes (Table 25).

For over 40% of the sample of infants <6m, it was not possible to calculate WHZ and WHM. This was mostly due to infants having height of <49 cm, for which there are no WHZ and WHM references. The range of missing data for infants <6m varied widely between countries and programme type (Table 25).

The number of anthropometric values that were flagged using the Epi-Info criteria was also investigated. Here, more anthropometric values were flagged for children >6m than for infants <6m (Table 26). Epi-Info flagging criteria might not be appropriate for a malnourished population, as it singles out a significant proportion of a roughly normally distributed sample of malnourished children. Flagging outliers using other criteria might be more appropriate. This is explored in Figure 20, where the Grubbs method for outlier identification was used to evaluate between true and false outliers.

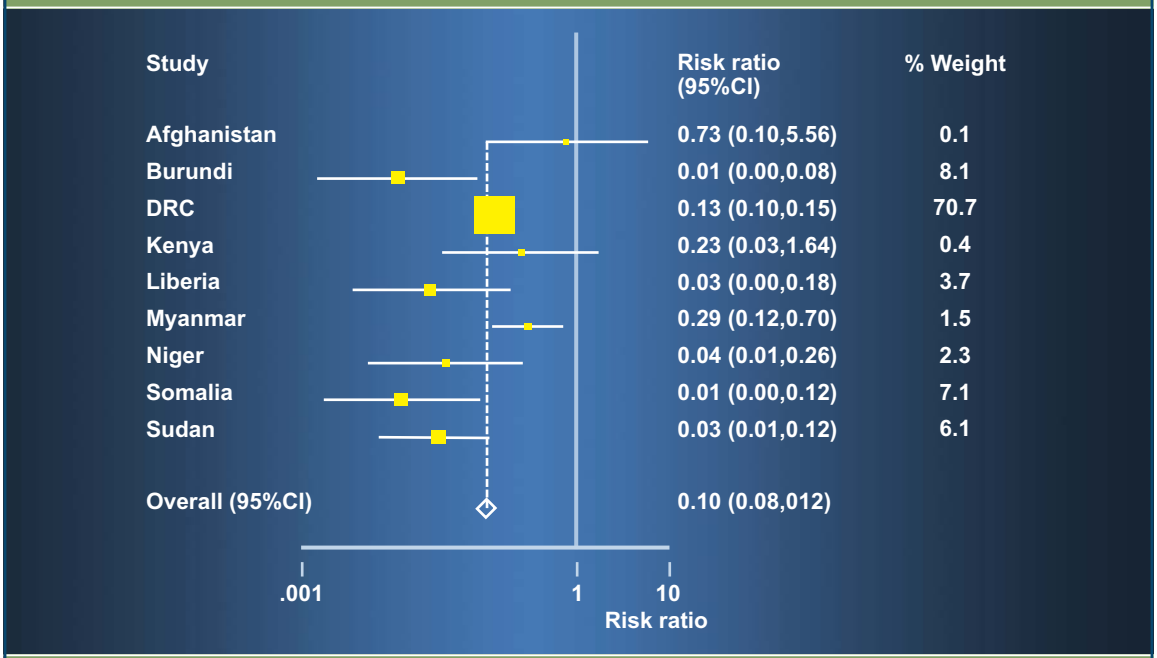
5.5.6 Infant malnutrition profile: Anthropometry-based admission criteria

Different anthropometric criteria used for admission to different programmes were investigated (Table 27). Due to the lack of WHZ and WHM data in infants <6m, it was difficult to compare them with 6 to 59m children. More than one anthropometric indicator was used in many cases for admission of infants <6m. The majority of infants <6m did not fulfil standard anthropometric SAM criteria, (<-3 WHZ or <70%WHM) so must have been admitted to programmes on the basis of clinical or other criteria. Many guidelines noted using <4kg or <3.5kg as an admission criterion for this age group. Weight <4kg was observed in 90.5% of all infants <6m and weight <3.5kg in 81.8% (Table 27).

We did not tabulate how many infants and children had more than one criterion. More importantly, nor did we have any available data to say how many children had complications of malnutrition and other background risk factors such as decreasing weight on growth charts or recently stopped breastfeeding.

Figure 20: Forest plots of the risk ratio of presenting oedema for infants <6m compared to children aged 6 to 59 months by country and by programme type

a) Country



a) Programme type

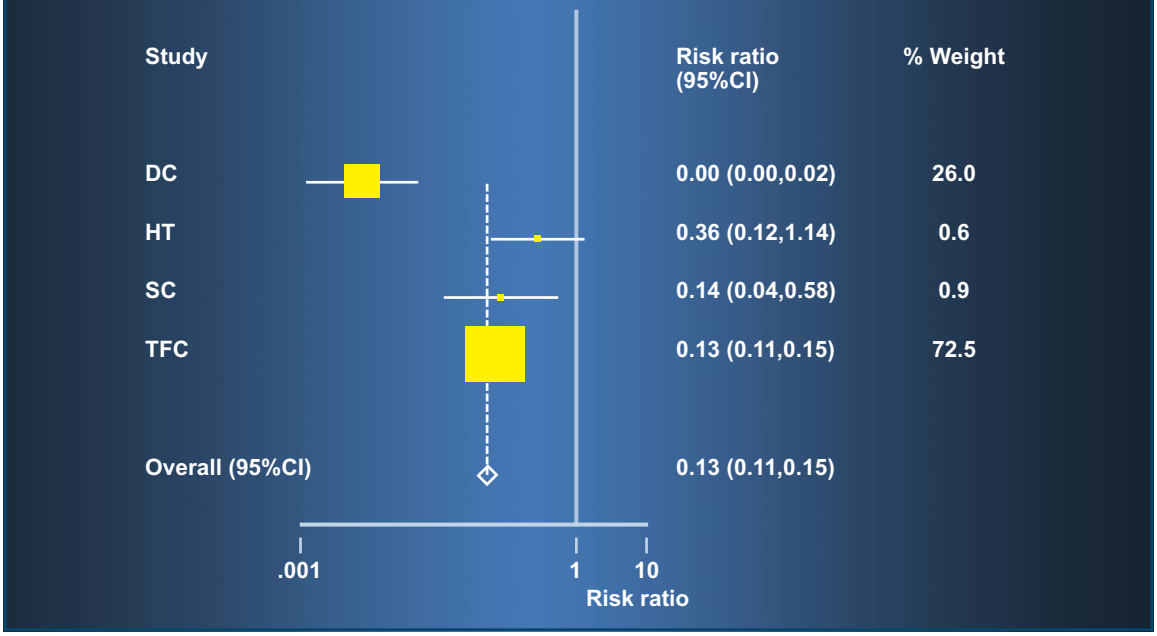


Table 24: Frequency and percentage of missing values of anthropometry by age group

	Variable/Indicator missing at admission														
Age group	Weight		Length/ Height		MUAC		WAZ		HAZ		WHZ		WHM		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
< 6 months	15	0.4%	227	5.7%	2,486	62.1%	19	0.5%	233	5.8%	1,607	40.2%	1,605	40.1%	4,002
6 to 59 months	130	0.6%	133	0.6%	5,156	24.9%	138	0.7%	149	0.7%	198	1.0%	192	0.9%	20,667
60 months	0	0.0%	1	0.2%	12	2.3%	0	0.0%	2	0.4%	3	0.6%	3	0.6%	526

MUAC: Mid-Upper Arm Circumference
WAZ: Weight-for-age z-score
HAZ: Height-for-age z-score
WHZ: Weight-for-height z-score
WHM: Weight-for-height percentage of the median

Table 25: Frequency and percentage of missing values of anthropometry by country and programme type in infants <6m

	Variable/Indicator missing at admission														
Country	Weight		Length/ Height		MUAC		WAZ		HAZ		WHZ		WHM		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Afghanistan	0	0.0%	1	0.1%	1,030	100.0%	0	0.0%	3	0.3%	252	24.5%	252	24.5%	1,030
Burundi	0	0.0%	4	2.7%	143	97.9%	0	0.0%	4	2.7%	72	49.3%	72	49.3%	146
Ethiopia	0	0.0%	4	12.1%	4	12.1%	0	0.0%	4	12.1%	11	33.3%	11	33.3%	33
Kenya	0	0.0%	6	16.2%	25	67.6%	0	0.0%	7	18.9%	7	18.9%	7	18.9%	37
Liberia	0	0.0%	6	3.6%	163	97.6%	0	0.0%	6	3.6%	40	24.0%	40	24.0%	167
Myanmar	0	0.0%	110	61.1%	180	100.0%	0	0.0%	111	61.7%	147	81.7%	147	81.7%	180
Niger	15	10.3%	31	21.4%	145	100.0%	15	10.3%	32	22.1%	72	49.7%	72	49.7%	145
DRC	0	0.0%	2	0.1%	27	1.9%	0	0.0%	2	0.1%	811	57.9%	809	57.8%	1,400
Somalia	0	0.0%	22	5.5%	378	94.0%	0	0.0%	22	5.5%	23	5.7%	23	5.7%	402
Sudan	0	0.0%	40	11.1%	352	97.8%	0	0.0%	41	11.4%	156	43.3%	156	43.3%	360
Tajikistan	0	0.0%	0	0.0%	34	39.5%	0	0.0%	0	0.0%	8	9.3%	8	9.3%	86
Uganda	0	0.0%	1	6.3%	5	31.3%	0	0.0%	1	6.3%	8	50.0%	8	50.0%	16
	Variable/Indicator missing at admission														
Programme type	Weight		Length/ Height		MUAC		WAZ		HAZ		WHZ		WHM		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
DC	0	0.0%	5	0.7%	735	99.6%	0	0.0%	6	0.8%	235	31.8%	235	31.8%	738
HT	0	0.0%	51	44.7%	114	100.0%	2	1.8%	52	45.6%	87	76.3%	87	76.3%	114
SC	0	0.0%	63	63.6%	70	70.7%	0	0.0%	63	63.6%	71	71.7%	71	71.7%	99
TFC	15	0.5%	108	3.5%	1,567	51.4%	17	0.6%	112	3.7%	1,214	39.8%	1,212	39.7%	3,051
Total	**15**	**0.4%**	**227**	**5.7%**	**2,486**	**62.1%**	**19**	**0.5%**	**233**	**5.8%**	**1,607**	**40.2%**	**1,605**	**40.1%**	**4,002**

DRC: Democratic Republic of the Congo
DC: Day Centre
HT: Home treatment
SC: Stabilisation centre
TFC: Therapeutic Feeding Centre
WHZ: Weight-for-height z-score
WHM: Weight-for-height percentage of the median

* The percentages in this table are based on the total sample of 4002 infants <6m and 20,667 children aged 6 to 59 months.

Table 26: Frequency of flagged values using Epi-info criteria by age group

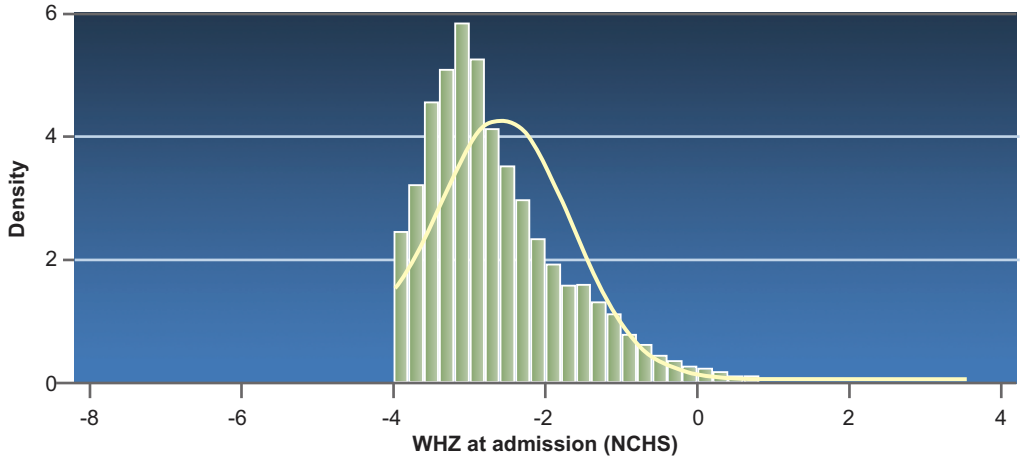
	Flag criteria										
Age group	Flag 1		Flag 2		Flag 3		Flag 4		Any flag		Total
	n	%	n	%	n	%	n	%	n	%	n
< 6 months	6	0.1%	95	2.4%	62	1.5%	2	0.0%	159	4.0%	4,002
6 to 59 months	392	1.9%	626	3.0%	1803	8.7%	3	0.0%	2548	12.3%	20,667
60 months	2	0.4%	42	8.0%	23	4.4%	0	0.0%	64	12.2%	526

Flag 1: HAZ <-6 or >+6
Flag 2: WHZ <-4 or > +6
Flag 3: WAZ <-6 or >+6
Flag 4: HAZ >3.09 & WHZ <-3.09 or HAZ <-3.09 & WHZ >3.09

* The percentages in this table are based on the total sample of 4002 infants <6m and 20,667 children aged 6 to 59 months.

Figure 21: WHZ distribution at admission of children aged 0 to 60 months

a) Distribution excluding values using Epi-Info flagging criteria



a) Distribution excluding values using Epi-Info flagging criteria

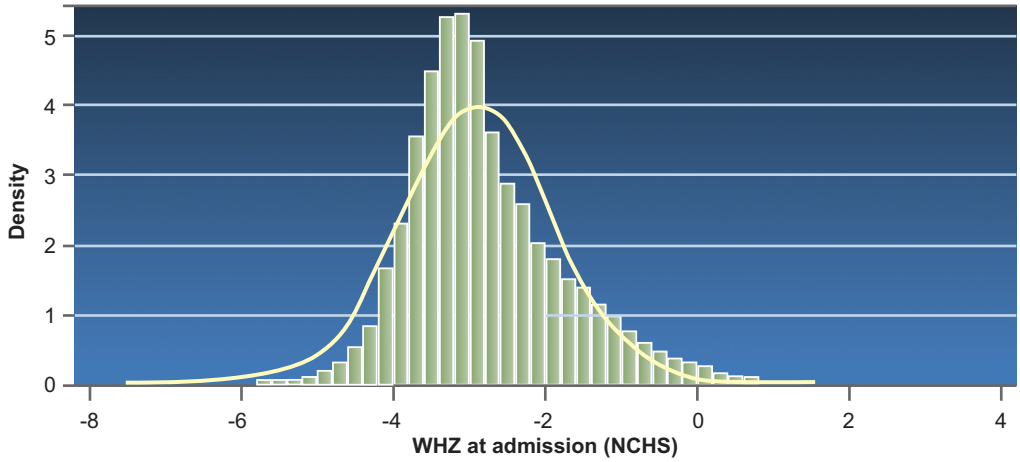


Table 27: Frequency table for different admission criteria, comparing infants <6m and children 6 to 59 months of age*

	Variable / Indicator																			
	<-3 WHZ				<70% WHM				<4 kg weight				<3.5 kg weight				<65 cm height			
Country	<6 months		6 to 59 months		<6 months		6 to 59 months		<6 months		6 to 59 months		<6 months		6 to 59 months		<6 months		6 to 59 months	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Afghanistan	160	15.5%	16	25.4%	340	33.0%	25	39.7%	975	94.7%	62	98.4%	849	82.4%	46	73.0%	1,014	98.4%	62	98.4%
Burundi	14	9.6%	393	19.5%	28	19.2%	341	16.9%	144	98.6%	57	2.8%	141	96.6%	39	1.9%	140	95.9%	103	5.1%
DRC	82	5.9%	936	20.2%	293	20.9%	1,058	22.8%	1,250	89.3%	254	5.5%	1,201	85.8%	109	2.4%	1,280	91.4%	461	9.9%
Ethiopia	3	9.1%	4	16.7%	5	15.2%	4	16.7%	29	87.9%	21	87.5%	27	81.8%	16	66.7%	28	84.8%	21	87.5%
Kenya	7	18.9%	308	62.3%	16	43.2%	289	58.5%	25	67.6%	17	3.4%	20	54.1%	9	1.8%	21	56.8%	37	7.5%
Liberia	25	15.0%	1,020	45.4%	56	33.5%	872	38.8%	152	91.0%	65	2.9%	128	76.6%	23	1.0%	154	92.2%	256	11.4%
Myanmar	2	1.1%	590	49.6%	10	5.6%	563	47.4%	173	96.1%	58	4.9%	171	95.0%	33	2.8%	68	37.8%	104	8.7%
Niger	19	13.1%	414	43.0%	35	24.1%	430	44.7%	106	73.1%	89	9.2%	100	69.0%	54	5.6%	92	63.4%	148	15.4%
Somalia	155	38.6%	1,347	52.6%	305	75.9%	1,449	56.5%	364	90.5%	220	8.6%	292	72.6%	73	2.8%	369	91.8%	508	19.8%
Sudan	43	11.9%	3,326	67.5%	64	17.8%	3,225	65.4%	320	88.9%	132	2.7%	278	77.2%	49	1.0%	314	87.2%	444	9.0%
Tajikistan	13	15.1%	219	76.3%	24	27.9%	237	82.6%	68	79.1%	44	15.3%	50	58.1%	30	10.5%	81	94.2%	84	29.3%
Uganda	1	6.3%	336	26.6%	5	31.3%	292	23.2%	16	100.0%	18	1.4%	16	100.0%	6	0.5%	15	93.8%	50	4.0%
Programme	<6 months		6 to 59 months		<6 months		6 to 59 months		<6 months		6 to 59 months		<6 months		6 to 59 months		<6 months		6 to 59 months	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
DC	118	16.0%	403	19.6%	213	28.9%	354	17.2%	703	95.3%	98	4.8%	626	84.8%	66	3.2%	729	98.8%	144	7.0%
HT	1	0.9%	523	51.8%	8	7.0%	495	49.1%	109	95.6%	46	4.6%	108	94.7%	26	2.6%	61	53.5%	86	8.5%
SC	4	4.0%	166	54.2%	7	7.1%	151	49.3%	93	93.9%	33	10.8%	90	90.9%	23	7.5%	35	35.4%	40	13.1%
TFC	401	13.1%	7,817	45.2%	953	31.2%	7,785	45.0%	2,717	93.9%	860	5.0%	2,449	80.3%	372	2.2%	2,751	90.2%	2,008	11.6%
Total	**524**	**13.1%**	**8,909**	**43.1%**	**1,181**	**29.5%**	**8,785**	**42.5%**	**3,622**	**89.1%**	**1,037**	**5.0%**	**3,273**	**81.8%**	**487**	**2.4%**	**3,576**	**89.4%**	**2,278**	**11.0%**

DRC: Democratic Republic of the Congo; **DC:** Day Centre; **HT:** Home treatment; **SC:** Stabilisation centre; **TFC:** Therapeutic Feeding Centre.**WHZ:** Weight-for-height z-score; **WHM:** Weight-for-height percentage of the median.

* The percentages in this table are based on the total sample of 4002 infants <6m and 20,667 children aged 6 to 59 months.

5.5.7 Programme outcomes

Programme outcomes were compared between infants <6m and children aged 6 to 59m by country and by programme type (Table 28 and Table 29). Overall, 75% of infants <6m (and 74% of 6 to 59m olds) were discharged as 'cured' and 4.7% of infants <6m (and 4% of 6 to 59m olds) died.

Taken as a whole, few countries met all Sphere standards (Table 28, values in italics). Only 25% (3) of countries reached the required Sphere standard of >75% cured rates in infants <6m compared to 42% (5) in children six to 59 months old. 66% (8) of countries met the mortality Sphere standard (<10%) for infants <6m, compared to 60% (9) for six to 59 month olds. Conversely, all countries met the defaulting Sphere standard (<15%) for infants <6m, compared to 75% (9) for children six to 59 months of age. In addition to the Sphere standards, only 25% (3) of the countries presented an acceptable non-recovery rate (<10%) for infants compared to 50% (6) for children aged six to 59 months. Applying the WHO inpatient guidelines on mortality standards to infants <6m, 50% (6) had mortality < 5% ('good'), 16% (2/12) had 'moderate' rates (5-10%) and 33% (4/12) had or exceeded 'poor' rates (11-20%). For children 6 to 59m, the rates were 67% (8/12), (1/12) and 3/12) for good, moderate and poor mortality, respectively.

Interestingly, this pattern changes when outcomes are grouped by programme type (Table 29, values in italics) where DC and HT programme types met the Sphere standard cured rate for infants <6m, but only DC in children aged five to 59 months. Similarly, only TFC programme type for infants <6m failed to met the non-recovery rate while HT, SC and TFC programmes failed for older children. All different programme types met the Sphere standards for mortality.

A Forest plot (Figure 22) displays the same data (from Tables 28 and 29) by evaluating the risk ratio of death as an outcome for infants <6m compared to children aged six to 59 months. Overall, the risk of death for infants <6m is 1.3 (1.08 – 1.53) if analysed by country, and 1.2 (1.05 – 1.44) if analysed by programme. There was a significant degree of heterogeneity on the data ($p<0.01$). However, the pattern remained unchanged after controlling for random effects.

Mortality as outcome data was available in some summary databases provided to the MAMI Project. Results were analysed and are shown in Figure 23. The mortality risk seen for infants <6m in TFC programme type within Burundi (Figure 23a) was 2.2 (1.69 – 2.96, $p<0.01$). There was no evidence of heterogeneity ($p=0.16$) in the data and the pattern remain unchanged after controlling for random effects. On the other hand, the infant mortality risk from MSF compiled data was 1.1 (0.83 – 1.45; $p=0.5$), with no evidence of heterogeneity ($p=0.4$) and the pattern did not change after controlling for random effects.

Table 28: Sphere discharge outcomes by country and age group
*Values in italics are those meeting the Sphere standards/MAMI indicator**

<6 month	Sphere discharge outcomes												
Country	Cured		Died		Excluded		Non-recovery		Defaulter		Missing		Total
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	
Afghanistan	769	74.7%	*49*	*4.8%*	0	0.0%	*96*	*9.3%*	*115*	*11.2%*	1	0.1%	1,030
Burundi	108	74.0%	17	11.6%	1	0.7%	*8*	*5.5%*	*4*	*2.7%*	8	5.5%	146
Ethiopia	21	63.6%	7	21.2%	0	0.0%	*1*	*3.0%*	*0*	*0.0%*	4	12.1%	33
Kenya	17	45.9%	9	24.3%	0	0.0%	6	16.2%	*5*	*13.5%*	0	0.0%	37
Liberia	117	70.1%	*5*	*3.0%*	0	0.0%	33	19.8%	*12*	*7.2%*	0	0.0%	167
Myanmar	135	75.0%	*5*	*2.8%*	2	1.1%	*7*	*3.9%*	*22*	*12.2%*	9	5.0%	180
Niger	101	69.7%	*11*	*7.6%*	4	2.8%	*1*	*0.7%*	*13*	*9.0%*	15	10.3%	145
DRC	1,099	78.5%	*50*	*3.6%*	3	0.2%	202	14.4%	*46*	*3.3%*	0	0.0%	1,400
Somalia	327	81.3%	*5*	*1.2%*	0	0.0%	*4*	*1.0%*	*40*	*10.0%*	26	6.5%	402
Sudan	245	68.1%	*26*	*7.2%*	1	0.3%	*33*	*9.2%*	*34*	*9.4%*	21	5.8%	360
Tajikistan	*68*	*79.1%*	*0*	*0.0%*	0	0.0%	*7*	*8.1%*	*11*	*12.8%*	0	0.0%	86
Uganda	*8*	*50.0%*	6	37.5%	0	0.0%	*0*	*0.0%*	*2*	*12.5%*	0	0.0%	16
Total	**3,015**	**75.3%**	**190**	**4.7%**	**11**	**0.3%**	**398**	**9.9%**	**304**	**7.6%**	**84**	**2.1%**	**4,002**
5 to 59 mo	Sphere discharge outcomes												
Country	Cured		Died		Excluded		Non-recovery		Defaulter		Missing		Total
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	
Afghanistan	*32*	*50.8%*	*4*	*6.3%*	0	0.0%	11	17.5%	15	23.8%	1	1.6%	63
Burundi	*1,710*	*85.0%*	*38*	*1.9%*	7	0.3%	*30*	*1.5%*	*61*	*3.0%*	166	8.3%	2,012
Ethiopia	*22*	*91.7%*	*1*	*4.2%*	0	0.0%	*1*	*4.2%*	*0*	*0.0%*	0	0.0%	24
Kenya	295	59.7%	58	11.7%	0	0.0%	*43*	*8.7%*	98	19.8%	0	0.0%	494
Liberia	*1,827*	*81.2%*	*15*	*0.7%*	2	0.1%	*213*	*9.5%*	*192*	*8.5%*	0	0.0%	2,249
Myanmar	821	69.0%	*11*	*0.9%*	46	3.9%	172	14.5%	*95*	*8.0%*	44	3.7%	1,189
Niger	*555*	*57.6%*	116	12.0%	6	0.6%	*90*	*9.3%*	*77*	*8.0%*	*119*	*12.4%*	963
DRC	*3,752*	*81.0%*	*183*	*3.9%*	23	0.5%	497	10.7%	*179*	*3.9%*	0	0.0%	4,634
Somalia	*2,000*	*78.0%*	*42*	*1.6%*	6	0.2%	*142*	*5.5%*	*222*	*8.7%*	151	5.9%	2,563
Sudan	3,329	67.6%	*222*	*4.5%*	11	0.2%	678	13.8%	*498*	*10.1%*	190	3.9%	4,928
Tajikistan	141	49.1%	*4*	*1.4%*	0	0.0%	79	27.5%	63	22.0%	0	0.0%	287
Uganda	836	66.3%	137	10.9%	4	0.3%	151	12.0%	*133*	*10.5%*	0	0.0%	1,261
Total	**15,320**	**74.1%**	**831**	**4.0%**	**105**	**0.5%**	**2,107**	**10.2%**	**1,633**	**7.9%**	**671**	**3.2%**	**20,667**

DRC: Democratic Republic of the Congo

* Sphere standard exit indicators are cure, death, defaulter and transfer. For the purpose of this analysis, excluded, non-recovery and missing are also reported (MAMI Indicator).

Table 29: Outcomes by programme type and age group
*Values in italics are those meeting the Sphere standards/MAMI indicator**

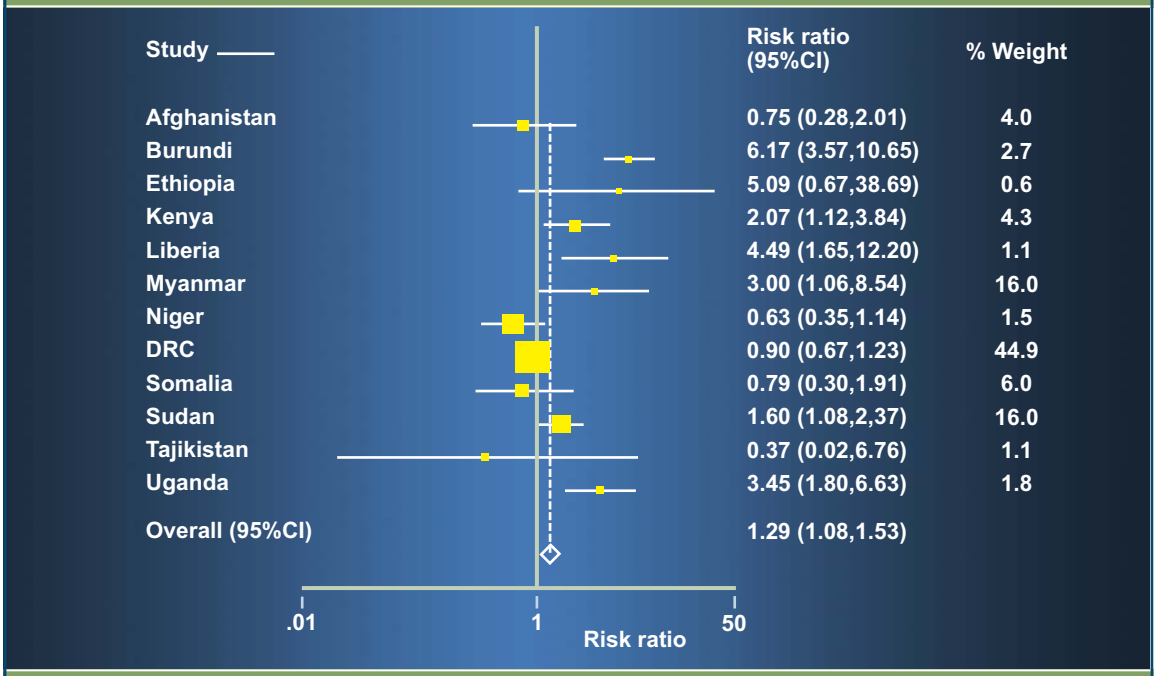
<6 months	Sphere discharge outcomes												
Programme	Cured		Died		Excluded		Non-recovery		Defaulter		Missing		Total
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	
DC	*605*	*82.0%*	17	2.3%	1	0.1%	*39*	*5.3%*	*68*	*9.2%*	*8*	*1.1%*	738
HT	*89*	*78.1%*	*4*	*3.5%*	2	1.8%	*6*	*5.3%*	*13*	*11.4%*	*0*	*0.0%*	114
SC	*67*	*67.7%*	*8*	*8.1%*	0	0.0%	*2*	*2.0%*	*9*	*9.1%*	13	13.1%	99
TFC	*2,254*	*73.9%*	*161*	*5.3%*	8	0.3%	351	11.5%	*214*	*7.0%*	*63*	*2.1%*	3,051
Total	**3,015**	**75.3%**	**190**	**4.7%**	**11**	**0.3%**	**398**	**9.9%**	**304**	**7.6%**	**84**	**2.1%**	**4,002**
6 to 59 months	Sphere discharge outcomes												
Programme	Cured		Died		Excluded		Non-recovery		Defaulter		Missing		Total
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	
DC	*1,735*	*84.5%*	*38*	*1.9%*	7	0.3%	35	1.7%	72	3.5%	166	8.1%	2,053
HT	*720*	*71.4%*	*7*	*0.7%*	44	4.4%	*161*	*16.0%*	*77*	*7.6%*	0	0.0%	1,009
SC	*191*	*62.4%*	*6*	*2.0%*	2	0.7%	*32*	*10.5%*	*30*	*9.8%*	45	14.7%	306
TFC	12,674	73.3%	780	4.5%	52	0.3%	*1,879*	*10.9%*	1,454	8.4%	460	2.7%	17,299
Total	**15,320**	**74.1%**	**831**	**4.0%**	**105**	**0.5%**	**2,107**	**10.2%**	**1,633**	**7.9%**	**671**	**3.2%**	**20,667**

DC: Day Centre; **HT:** Home Treatment; **SC:** Stabilization Centre; **TFC:** Therapeutic Feeding Centre

* Sphere standard exit indicators are cure, death, defaulter and transfer. For the purpose of this analysis, excluded, non-recovery and missing are also reported (MAMI Indicator).

Figure 22: Forest plots of the risk ratio of dying for infants <6m compared to children aged 6 to 59 months by country and by programme type using data from the 'raw' datasets

a) Country



a) Programme type

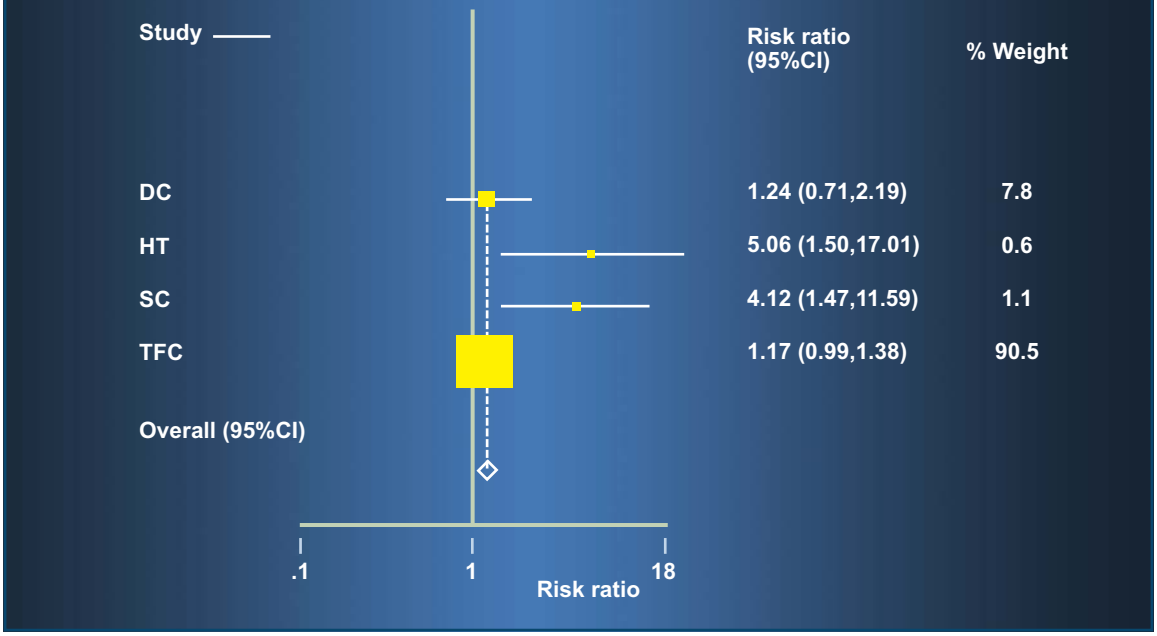
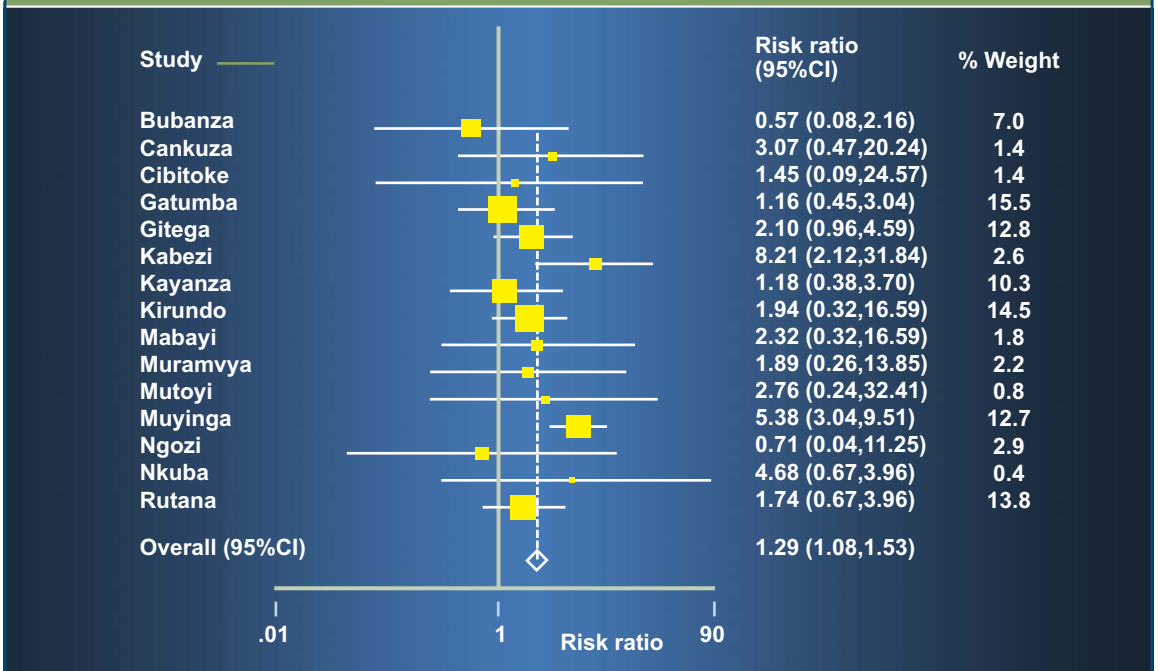
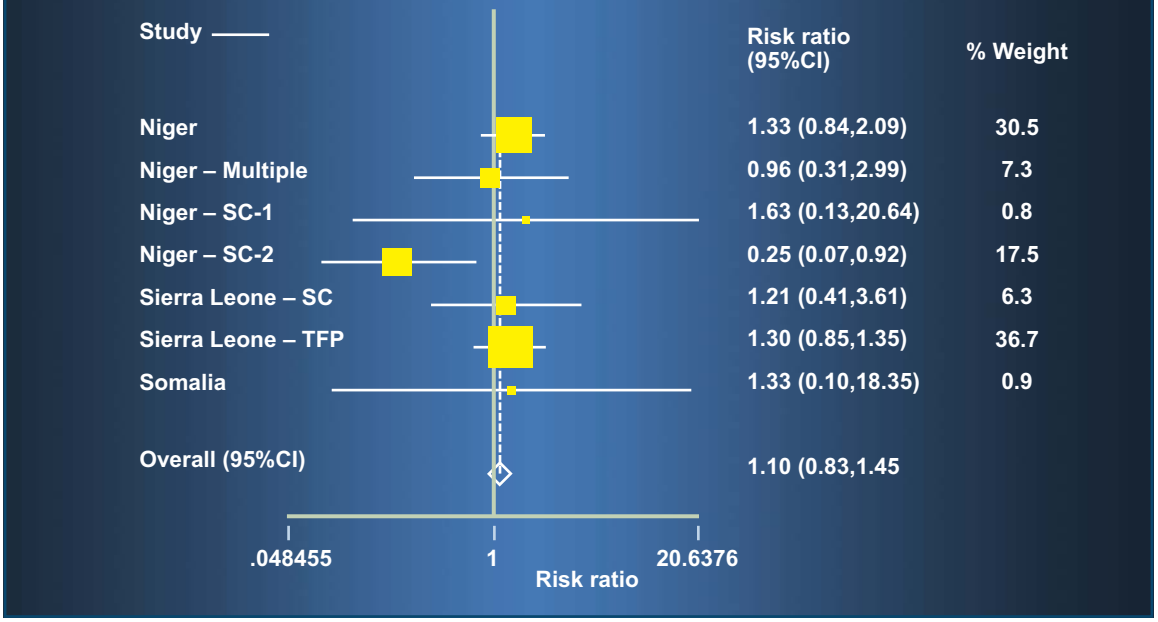


Figure 23: Forest plots of the risk ratio of dying for infants <6m compared to children aged 6 to 59 months in Burundi by different TFC centres and by different programmes, using compiled data from various agencies

a) by different TFC centres



a) by different programmes



5.6 Discussion

5.6.1 Key findings

In our analysis of data from 33 datasets from 12 countries we showed that an approximate 16% of admissions for severe malnutrition care are infants <6m ranging from 10% in Home Treatment (HT) to 25% Day Centre (DC) programmes. This range of variability was greater when analysed by country. We also showed that the burden of malnutrition in infants <6m forms part of the distribution of malnutrition in children less than 60 months old, starting immediately after birth, which seems to peak between the ages of six to 24 months and presents a significant decline after 36 months of age. In addition, the proportion of severely malnourished males is greater in infants <6m than that in their older counterparts.

One significant and consistent difference found was that infants <6m are less likely to present oedema. The risk ratio for presenting oedema in infants <6m was 0.1 (ranging from 0.08 – 0.12, p<0.01) when compared to children aged six to 59 months. This risk varied widely by country and programme type, but was consistently lower in infants <6m.

Operationally, we showed that even within one agency, there is a significant variation in the way data is recorded, structured, entered and coded. This makes data cleaning, analysis and interpretation resource intensive and challenging, highlighting the importance for the development and implementation of minimum reporting standards. Within this variation patterns emerged. Infants <6m in general, showed more missing variables/indicators at admission, height being the most commonly missed, clustered mostly in HT and Stabilisation Centre (SC) programme types. Weight-for-height % median (WHM) was also difficult to calculate in this group mostly due to a significant proportion having lengths of <49cm.

As expected, infants <6m presented higher rates of mortality with a risk ratio of 1.29 (ranging from 1.08-1.53, p<0.01). This increased rate was also observed in compiled data from different Therapeutic Feeding Centres (TFCs) in Burundi but was not observed in MSF complied data from various sources. It is not known how much of this difference in mortality is to be expected, due to the greater background vulnerability of this age group. It is also important to note that the lack of contextual and survey data on infants <6m meant it was not possible to compare inpatient mortality with mortality amongst infants <6m in the general population.

Few countries met all Sphere exit indicators for therapeutic care of severely malnourished infants <6m (Correction of Malnutrition Standard 2). Variations in outcome between different programmes need exploration to find out how much this reflects programme/ guidelines performance and how much patient clinical profile on admission. Current indicators to achieve Sphere Standards (2004) to correct malnutrition have their limitations with regard to infants <6m. It is not clear whether Sphere exit indicators for children under five years include infants< 6m. While a Sphere indicator is included on the importance of breastfeeding and psychosocial support in SAM treatment, there is no clear guidance on how to measure this. The staff: patient ratio (1:10) recommended may also not be applicable, given the level of support warranted for infants <6m. A process of quality improvement in programming will help inform development of Sphere Standards for infants <6m.

There is an absence of standard infant feeding indicators in programme data such as breastfeeding status on admission and on discharge. Exclusive breastfeeding has been identified as a main treatment outcome in infants <6m (Chapter 5). Continued breastfeeding to two years and beyond significantly contributes to infant and young child food security. Sub-optimal feeding practices may contribute to acute malnutrition. Therefore standardised feeding status data is needed to both inform treatment and audit.

5.6.2 Strengths and weaknesses of the analysis

The size of the database analysis in this chapter is a major strength of our work. It allowed us to compare and contrast different programmes, from different countries, from different time periods. Limitations are as follows:

- *Data source:* Data analysed is primarily from one relatively well resourced, highly experienced, technically able non-governmental organisation (NGO) whose programmes likely represents the 'top end' of a wide range of field practices.

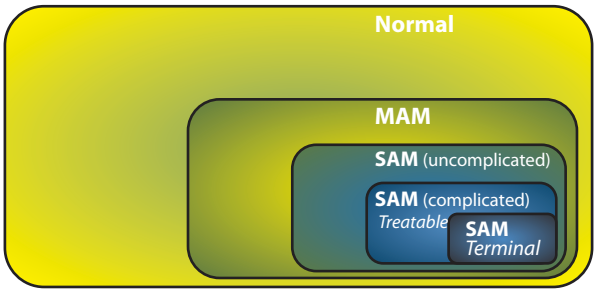
- *Need for intensive data cleaning with time & resource limitations:* Databases required intensive processing before analysis, which required months of dedicated person-time. This is possible within a research setting, but difficult within a field-focused organization where the time delay would limit the application of learning.
- *Validity and reliability issues:* Given the extent of cleaning and processing that were needed to harmonize the field databases, it is likely that field practices also varied significantly between sites and programmes. In an ideal analysis, quality and validity of the whole data flow system, from patient to final database, would be verified.
- *Coverage data*: There was no available data on programme coverage. This makes it impossible to assess population impact, i.e. a hypothetical programme with 100% coverage but 50% death rate makes a greater impact than a programme with 50% coverage but 10% deaths.
- *Interpretation of outcome data given limited variables*: Many programmes did not reach Sphere standards to correct severe malnutrition. However, given lack of even basic context data on clinical condition of children presenting to care, it is not possible to say how much of that shortfall represents suboptimal programme effectiveness and how much reflects a high risk patient caseload. This is presented visually in Figures 25-28.

TFP/SFP outcome = programme effectiveness x 1/risk of death at admission

(i.e. good outcome = highly effective programme x low risk patient)

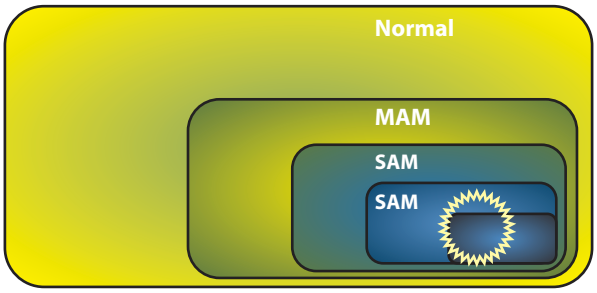
TFP/SFP outcome = programme effectiveness x 1/risk of death at admission
(i.e. good outcome = highly effective programme x low risk patient)

Figure 24: Hypothetical population showing the relationship between different types of acute malnutrition.



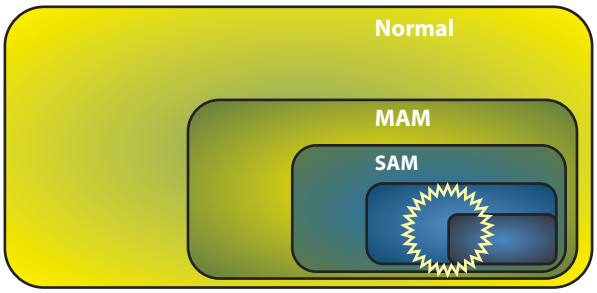
Whether or not these standards are achieved is often seen as a function of programme performance. Indeed, ensuring that humanitarian response programmes were working effectively and safely (e.g. by following accepted/acceptable clinical guidelines) was part of the orginial drive behind Sphere. However, it should not be forgotten – and it is of great relevance to interpretation of MAMI data – that patient caseload can also play a major part in how 'effective' a programme may appear:

Figure 25: Programme with poor outcomes



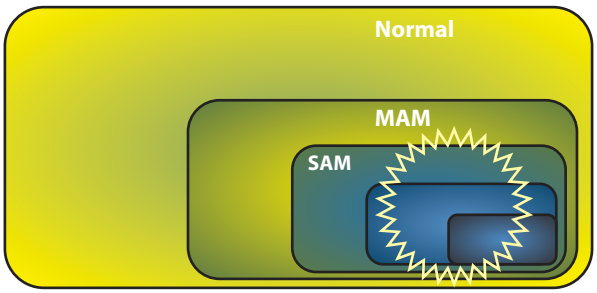
This programme may actually have very good staff/case management – yet it performs badly because patients present too late to benefit from even the best of treatments.

Figure 26: Programme with better outcomes



Staff in this programme may manage their cases of SAM worse than in the 1st programme, yet still get better outcomes simply because patients are less sick and less vulnerable at admission

Figure 27: Programme with good outcomes



Focus on uncomplicated SAM is likely lead to good outcomes. Programme coverage is also high and has higher probability of public health impact. However, numbers of deaths actually averted will vary according to risk of death in each category

Key to Figures 24-27
Normal: nourished sub-population
MAM: sub-population with moderate acute malnutrition
SAM: sub-population severe acute malnutrition (with or without complications)

SAM (terminal): SAM presenting at such a late stage that any treatment, however high quality, is unlikely to prevent mortality

Sub-population in treatment programme

5.6.3 Future directions

The results provide a good baseline for future work. Future analyses are important to continue to monitor trends and patterns in MAMI and to indicate effects of future management guideline changes. However, this will require significant changes to current data systems, as follows:

- Quality of data throughout the entire system monitored and enhanced, from data collection to data entry.
- More structured, probably specially constructed, databases with validation and consistency cross-checks at data entry stage.
- Harmonised database structures and coding strategies.
- Ascertain what are the most appropriate variables to measure in infants <6m and collect routinely.

In the area of moderate malnutrition management, there is work well in progress to standardise reporting and establish minimum reporting standards in SFPs, focused on children 6 to 59m[146]. This approach could be applied to infants <6m. In addition, an update in the SFP reporting package to include infants<6m is recommended.

Data on infants <6m must be included in nutrition surveys to assess initial needs and later programme coverage. Clinical variables should also be collected to enable better interpretation of programme outcomes.

Lastly, different approaches to field data could be considered. Rather than a long term audit of routine data, short term, more focused, periods of data collection might be considered. These would aim to answer specific operational research questions (e.g. how many malnourished infants <6m are LBW?) during a set period of time, after which normal 'minimal' data collection could resume.

5.7 Summary findings and recommendations

Summary findings

Infants <6m are admitted to feeding programmes, and do therefore warrant attention and resources.

Significant work is needed to harmonize and improve the quality of field databases. Standardisation in reporting is needed, including database structure, case definitions, outcome coding and variable formatting, to facilitate future research and routine audit.

Overall, infants <6m had a higher proportion of measurements missing or wrongly recorded. Missing values for length were greater in infants <6m. MUAC is being measured in infants <6m in SC and TFC programmes against current recommendations. Staff training and appropriate equipment are needed to improve the quality of anthropometric assessment in this age-group.

Feeding programme data should be disaggregated by age, to enable closer analysis. Routine indicators of feeding status on entry and exit to programmes are necessary.

Percentage mortality in admitted infants <6m was significantly higher than admitted children aged 6 to 59m (4.6% vs 4% respectively, $p<0.01$). There was no data on mortality of infants <6m not admitted.

Few countries met all Sphere exit indicators for therapeutic care of infants <6m (Correction of Malnutrition Standard 2). Current indicators to achieve Sphere Standards (2004) to correct malnutrition have their limitations with regard to infants <6m.

Presence of oedema was consistently lower in infants <6m. The risk ratio of presenting oedema was 0.1 (range: 0.08 – 0.12) when compared to children aged six to 59 months.

There are significant inter-database variations in structure, coding and data entry, even within agencies. Data cleaning, analysis and interpretation is thus time intensive and challenging.

Summary recommendations

Attention and resources should be diverted to MAMI in feeding programmes and a process of quality improvement should be implemented to help programmes to reach Sphere Standards for infants <6m and to reduce the proportion of deaths in this age group.

Staff training and appropriate equipment are needed to improve the quality of anthropometric assessment of infants <6m.

Feeding programme data should be disaggregated by age, to enable closer analysis. Routine indicators of feeding status on entry and exit to programmes are necessary.

Standardisation in reporting is needed, including database structure, case definitions, outcome coding and variable formatting, to facilitate future research and routine audit. Significant work is needed to harmonize and improve the quality of field databases. There are lessons to learn from the SFP Minimum reporting Standards Package under development and an update in the SFP reporting package to include infants <6m is warranted.

Few countries met all Sphere exit indicators for therapeutic care of infants <6m (Correction of Malnutrition Standard 2). Current Sphere indicators to correct malnutrition have their limitations with regard to infants <6m. The MAMI report findings should inform Sphere Standards update. A process of quality improvement should be implemented to help programmes to reach Sphere Standards for infants <6m.

Endnotes

[145] None of these recoded cases where WHM <80% reached the final analysis.
[146] Minimum Reporting Standards for SFP project. http://www.ennonline.net/research/sfp.aspx