Nutritional Assessment of Children 0-12 Years Enrolled in the SMRU Vaccination Campaign for Migrant Population

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EXECUTIVE SUMMARY

Burma' reported chronic malnutrition prevalence in children under the age of five is one of the highest in Southeast Asia and acute malnutrition prevalence is classified by the WHO as severe, with over 10% prevalence. In refugee camps along the Thai-Burma border, acute malnutrition in children is mainly present among new arrivals and closely monitored. However, there are no formal statistics on the nutritional status among migrant children living in Thailand. We therefore took the opportunity of a mass vaccination campaign for children aged 0-12 years in 49 migrant schools to gather information on their nutritional status.

Children under-5 represented one third of the vaccination campaign population. In this age group, stunting (chronic malnutrition) prevalence was 25.2%; wasting prevalence (acute malnutrition) was 9.2%; and underweight prevalence, which is one of the nutritional targets of the Millennium Development Goals, was 21.0%. Stunting and underweight prevalence were similar to those reported by refugee camps on the Thai-Burma Border; wasting prevalence, however, was three-times higher. Stunting and underweight prevalence in the ≥ 60 months old group were similar to the younger age group; thinness (low Body Mass Index) prevalence was 13.0%.

This is, as far as we are aware of, a first evaluation of the nutritional status of children of migrant Burmese workers living in Tak province. Prevalence of stunting and underweight in under-5 was lower than in Burma, but twice as high as reported among children living in Northern Thailand. Malnutrition among older children was more difficult to evaluate as there are no comparative data available for this age group. However, underweight and thinness prevalence were surprisingly high, suggesting that older children might also suffer of nutritional deficiencies. Although the prevalence of stunting and underweight in the refugee camps reflects the situation encountered in Burma, acute malnutrition has almost disappeared. Migrant children situation differs from that of children living in refugee camps. The food supply for the latter is regular; access to health care is free; immunization coverage is excellent. Success in reducing malnutrition among children depends on the sustainability of the intervention and whether children enrolled are likely to benefit from it for an adequate length of time; both criteria are presently unmet for this particular population and need further consideration.

INTRODUCTION

Thailand's more privileged economic situation and favorable social and political climate draws migrant workers from Burma each year. These migrant workers serve as an important reservoir of labor, without which Thailand's GDP could fall by 0.5%[1]. The districts within Thailand's Tak Province host an uprooted population of approximately 200,000 Burmese migrant workers mostly from Eastern Burma where the health situation is critical due to the ongoing conflict over the last 50 years. This population has little or no access to healthcare within its own country nor benefit from the Thai public health services or the health care programs set in refugee camps.

The precariousness of the health situation along the Thai-Burmese border is illustrated by a much higher infant mortality rate in Eastern Burma compared to that reported at country level (148 infant deaths/1,000 live births as opposed to 92/1,000) or in Thailand (18 infant deaths/1,000 live births) [2-3].

A large proportion of child mortality in developing countries is associated with infectious diseases and malnutrition[4]; the lack of routine immunization among Burmese children migrating to Thailand with their parents is a gap in the basic health care needs that was addressed by the Shoklo Malaria Research Unit (SMRU). A mass catch-up immunization campaign has been carried out since June 2009 and is currently covering 49 schools in four districts of Tak Province; 33 in Mae Sot, 3 in Mae Ramat, 8 in Phop Phra and 5 in Tha Song Yang districts (**Fig. 1**).

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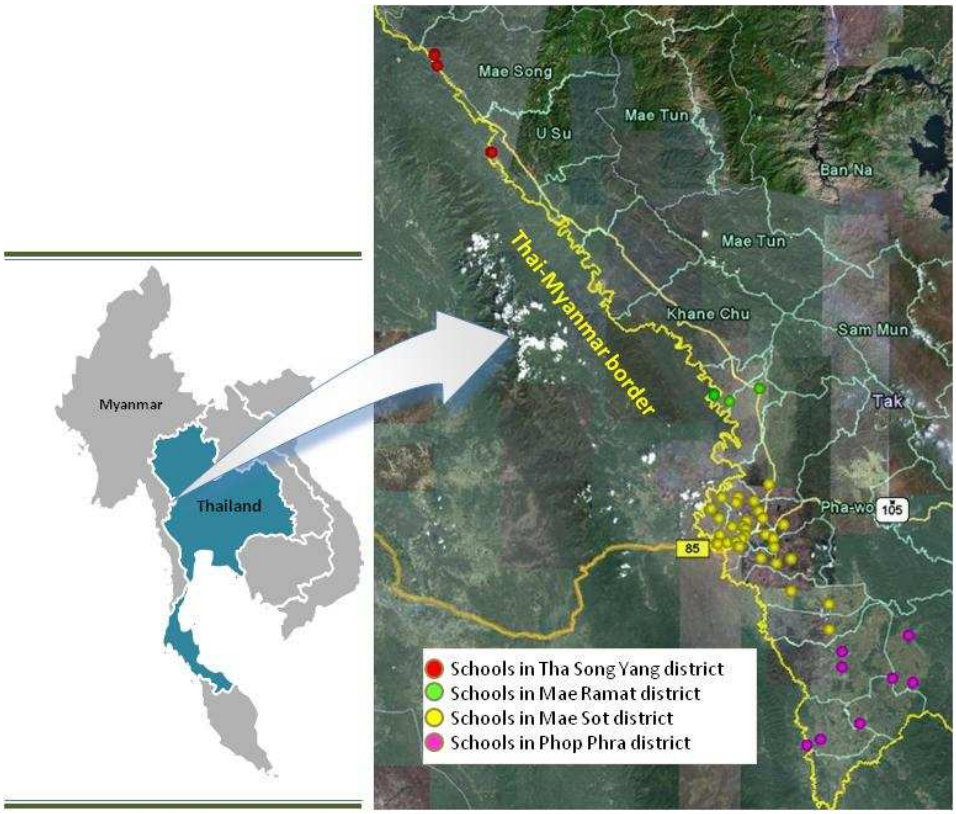

Fig.1. Location of 49 schools in 4 border districts of Tak province, Thailand

Some of the highest levels of chronic malnutrition in children under-five years of age are found in Asia and Burma' reported chronic malnutrition prevalence is one of the highest in Southeast Asia. In the other hand, nutritional status in Thailand has greatly improved over the last years and, although some acute malnutrition still exists, the country has already achieved part of the MDG # 2 by reducing underweight prevalence among under-5 years old from 18.6% to 8.5%[5].

NGOs in collaboration with health agencies supervise and report annual nutrition surveys in children under-5 years of age in all refugee camps along the Thai Burma Border where child acute malnutrition is rare and mainly present among new arrivals. However there are no formal statistics regarding the nutritional status of migrant children living in Thailand. We therefore took the opportunity of this vaccination program to describe the nutritional status of children of Burmese migrants enrolled in the previously mentioned schools in Tak province.

[5] Office of the National Economic and Social Development Board.Thailand Millenium Development Goals Report 2004. Bangkok 2004.

METHODS

Children 0-12 years old were enrolled in the campaign from 26 June to 29 November 2009. Upon enrollment, information on age and sex was reported. Anthropometric measurements collected were: weight, height and middle upper left arm circumference (MUAC).

Age

Age was calculated as the difference between the date of examination (DOE) and the date of birth (DOB)/30.4375. The date of birth was noted from school registers. When birth certificates were available, the school used these to determine the child's DOB. In most cases, the school used verbal recall from the guardian of the child together with a local calendar of events to determine DOB. When neither was possible, the age (in years and/or months) was requested from the teacher and/or the child. Even though teachers do their best in collecting precise information, the accuracy of the date of birth is not always fully known. The vaccine team compared the date of birth with the actual age of the child and in a few cases when the date of birth did not correlate with the age of the child, the age was used in preference. This challenge was further hindered by lack of communication with the children's parents/guardians.

Anthropometry

For children unable to stand, a floor board was used to measure their height. For all other children, height was measured using a measuring tape carefully glued on a wall. In both cases, height was measured to the nearest 0.1 cm. All children were measured bare foot and their posture was adjusted uniformly. For children unable to stand, weight was measured using a hanging baby scale with a 15 kg capacity and was recorded to the nearest 100 grams. For older children a mechanical dial weighing scale with capacity of 150 kg was used and their weight was recorded to the nearest 0.5 kg. All children were weighed bare foot and wearing minimal clothes. Mid Upper Arm Circumference (MUAC) was measured using a SECA insertion tape and was recorded to the nearest 0.1 cm. All the measurements were performed by three trained members of the vaccine team. Body Mass Index (BMI) was calculated as the weight (in kg)/height^2 (in m).

The World Health Organization (WHO) child growth indicators were used for this analysis[6]. Indicators were based on the following anthropometry indices: height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), weight-for-height z-scores (WHZ), BMI z-scores (BMIZ); however age-limit was not identical for all indicators: HAZ and BMIZ were available for children from birth until 19 years of age, WAZ for children from birth until 10 years of age and WHZ for children from birth until 5 years of age.

The various aspects of malnutrition for children 0-59 month of age were reported following the internationally recognized definitions proposed by WHO/UNICEF[7-8].

Definitions used for nutrition in 0-59 month old children:

1. Wasting (acute malnutrition) was defined as a WHZ of < -2

   Severe wasting was considered if WHZ was < -3 OR if MUAC < 11.5 cm
2. Stunting (chronic malnutrition) was defined as a HAZ of < -2

   Severe stunting was considered if HAZ was < -3
3. Underweight (mixed acute and chronic malnutrition) was defined as a WAZ of < -2

   Severe underweight was considered if WAZ was < -3

Several indicators of malnutrition exist for older children; however most nutritional surveys do not measure children older than 59 months and national and international statistics do not report information on this age group. Therefore in this particular age-group we decided to report stunting and underweight indicators (as is for the 0-59 month old group). Because WHZ indices are not available for children older than 59 months, we looked at BMI, a measure of body fat, to evaluate the prevalence of thinness in this age group[9].

[6]The WHO Child Growth Standards. World Health Organization 2009. Available from: http://www.who.int/growthref/en/ and http://www.who.int/childgrowth/standards/en/.
[7] UNICEF. Tracking progress on child and maternal nutrition; a survival and development priority. UNICEF 2009.
[8] WHO/UNICEF. WHO child growth standards and the identification of severe acute malnutrition in infants and children. A joint statement by the World Health Organization and the United Nations Children's Fund. 2009.
[9] About BMI for children and teens. Available from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html

Definitions used for nutrition in ≥ 60 month old children:

1. Thinness (measure of body fat) was defined as a BMIZ of < -2

   Severe thinness was considered if BMIZ was < -3

2. Stunting (chronic malnutrition) was defined as a HAZ of < -2

   Severe stunting was considered if HAZ was < -3

3. Underweight (a mix of acute and chronic malnutrition) was defined as a WAZ of < -2 for children up to 10 years of age.

   Severe underweight was considered if WAZ was < -3

Statistical Analysis

Anthropometric indices were calculated using the WHO Syntax for SPSS[10]. Normally distributed variables were expressed as a mean, standard deviation (SD) and [range]. Categorical variables were expressed in percentage. T-test and Chi-square tests were used to compare means and proportions respectively. Comparison of columns proportions were done by z-tests with Bonferroni correction. Variables that might have been associated with stunting, wasting, underweight and thinness were evaluated in univariate analysis.

Disease outbreak was defined as an outbreak of a vaccine preventable disease (measles, mumps, rubella or chicken pox), occurring in the two months prior to the anthropometric measurements being taken.

RESULTS

A total of 5,015 children aged 0-12 years were enrolled in this vaccination campaign. 77/5,015 children (1.5%) had anthropometric improbable measures (z-scores > +4 or < -4) which could not be verified on time for this analysis; they were therefore excluded from the results. They were 2,400 girls (48.6%) and 2,538 boys (51.4%) with an age-distribution shown on **Fig. 2**.

[10] WHO Child Growth Standards SPSS Syntax File. World Health Organization 2009. Available from: http://www.who.int/childgrowth/software/readme_spss.pdf

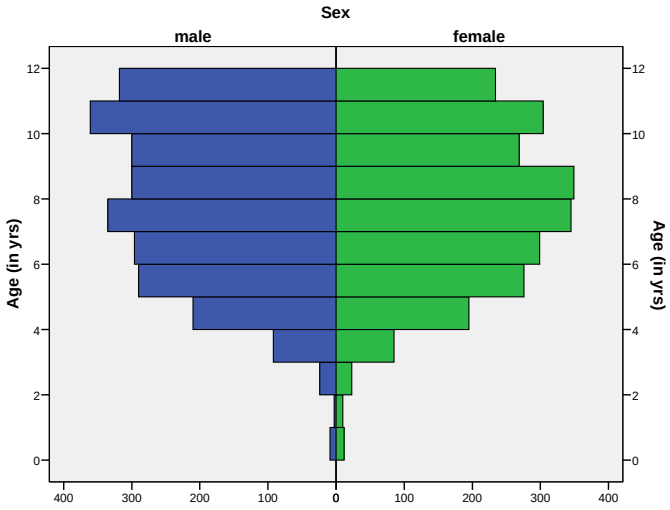

Fig.2. Age distribution of 4,938 children 0-12 years old, by sex

General characteristics of the children are presented in **Table 1**. Two-third of the children were enrolled in schools located in Mae Sot district, and 49% of them had access to at least one free meal per day during school.

The percentage of children 0-59 month old in each malnutrition category is shown in **table 2**. Severe underweight and wasting were rare. A MUAC value of less than 11.5 cm was not seen in any children.

Table 1. General characteristics of 4,938 children enrolled in SMRU vaccine campaign

Characteristics	
Boys (n, %)	2,538/4,938 (51.4%)
Age (in months)[1]	93 (29) [0-144]
Children 0-59 month old (n, %)	662/4,938 (13.4%)
Access to one meal per day (n, %)	2,384/4,938 (48.3%)
At school in:	
- Mae Sot district (n, %)	3,614/4,938 (73.2%)
- Mae Ramat district (n, %)	237/4,938 (4.8%)
- Phop Phra district (n, %)	868/4,938 (17.6%)
- Tha Song Yang district (n, %)	219/4,938 (4.4%)
In a school where outbreak happened (n, %)	520/4,938 (10.5%)

[1] expressed as mean, (SD) and [range]

Table 2. Proportion of children 0-59 month old in each malnutrition category

	0-59 month old
Wasting	61/662 (9.2%)
Severe wasting by WHZ	*7/662 (1.1%)*
Severe wasting by MUAC	*0/662 (0%)*
Stunting	167/662 (25.2%)
Severe stunting	*41/662 (6.2%)*
Underweight	139/662 (21.0%)
Severe underweight	*13/662 (2.0%)*

Stunting prevalence in older children was similar to the younger age group (**Table 3**). Underweight and severely underweight prevalences however were significantly higher in the ≥ 60 month old children than among the 0-59 month old (31% *vs*. 21%, $p < 0.001$ and 6.5% *vs*. 2.0%, $p < 0.001$ respectively). Severe thinness was however rare.

Table 3. Proportion of children ≥ 60 month old in each malnutrition category

	≥ 60 month old
Thinness	560/4,276 (13.0%)
Severe thinness	*79/4,276 (1.8%)*
Stunting	1,198/4,276 (28.0%)
Severe stunting	*222/4,276 (5.2%)*
Underweight	994/3,242 (30.7%)
Severe underweight	*212/3,242 (6.5%)*

Gender and provision of a daily meal were considered in univariate analysis as potential risk factors for wasting among the 0-59 month old (**Table 4**). The same variables were considered for potential risk of thinness in the older age group; none of those variables were significantly associated with either malnutrition group.

Table 4. Potential risk factors for wasting in univariate analysis

0-59 month old		P value
Male *vs.* Female	37/338 (10.9%) *vs.* 24/324 (7.4%)	NS
Meal *vs.* No meal	30/368 (8.2%) *vs.* 31/294 (10.5%)	NS

Four schools (2 in Mae Sot district, 1 in Tha Song Yang and 1 in Phop Phra) had an outbreak of measles and/or chicken pox prior to the anthropometric measurements. Five hundred twenty children (10.5%) were enrolled in those schools, 87 of them in the 0-59 month old group. Wasting among children enrolled in a school where disease outbreak occurred was not significantly different from those enrolled in other schools (**Table 5**).

Table 5. Proportion of wasting among 0-59 month old children in schools having had a disease outbreak or not

	Children attending school with history of outbreak	Children attending school without history of outbreak
Wasting	10 (11.5%)	51 (8.9%)
No wasting	77 (88.5%)	524 (91.1%)
Total	**87**	**575**

The highest proportions of 0-59 month old with stunting, underweight or wasting were seen among children going to schools located in Tha Song Yang district and the lowest among children going to schools in Phop Phra district (**Table 6**).

Table 6. Proportions of 0-59 month old children malnurished by category and by district

	Mae Sot	Mae Ramat	Phop Phra	Tha Song Yang
Wasting	52/545 (9.5%)	2/21 (9.5%)	4/74 (5.4%)	3/22 (13.6%)
Stunting	140/545 (25.7%)	6/21 (28.6%)	14/74 (18.9%)	7/22 (31.8%)
Underweight	119/545 (21.8%)	4/21 (19.0%)	8/74 (10.8%)	8/22 (36.4%)

Wasted children 0-59 month old were not found in every school: 22 schools had no children considered acutely malnourished. In the other schools, prevalence of wasting varied between 3.0% and 62.5% (**Fig. 3**). On the contrary, all schools but 2 had older children considered as thin, in proportions varying from 1.6% to 42.9%.

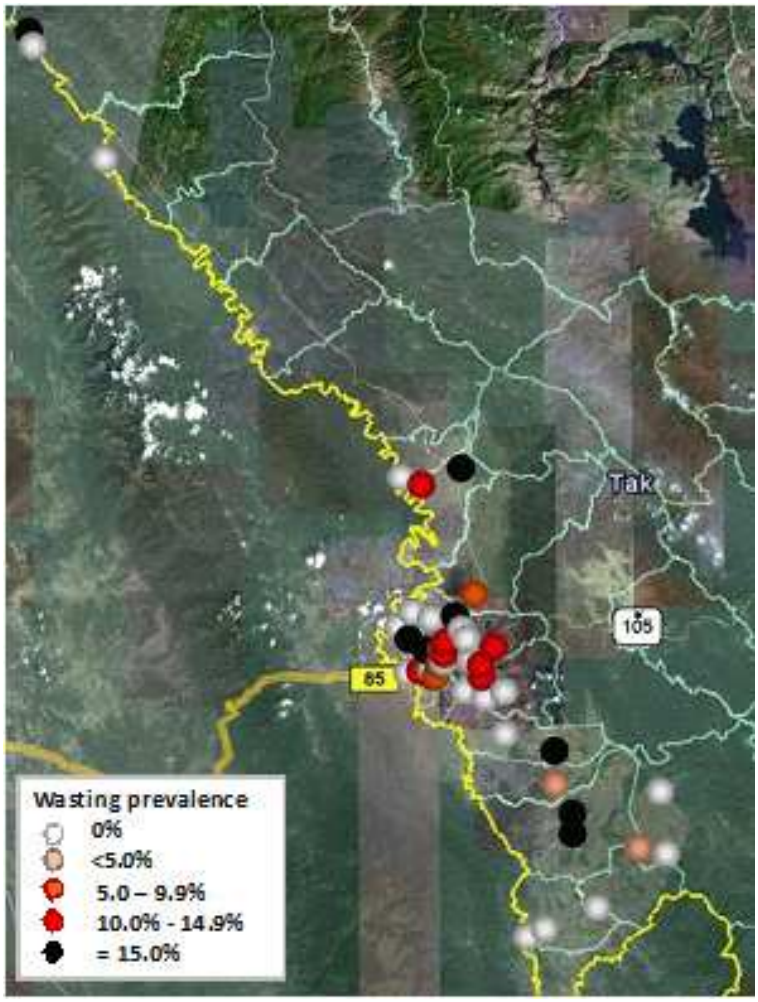

Fig. 3. Wasting prevalence in 0-59 month old by school

Two camps for displaced populations are located in two districts of Tak Province (Maela camp in Tha Song Yang district and Umpiem camp in Phop Phra). Nutritional surveys conducted in 2008[11] among a random sample of 6-59 month old children living in those camps showed a similar proportion a stunting and underweight, but less wasting, although those results were statistically not significantly different (**Table 7**).

[11] Annual Nutrition Survey Border-Wide Report 2008. Thailand Burma Border Consortium (TBBC). Thailand; 2008.

Table 7. Proportion of 0-59 month old children malnurished by category and location

	Tha Song Yang District		Phop Phra District	
	In school for migrants	In Maela camp	In school for migrants	In Umpiem camp
Wasting	3/22 (13.6%)	41/748 (5.5%)	4/74 (5.4%)	7/498 (1.4%)
Stunting	7/22 (31.8%)	271/748 (36.2%)	14/74 (18.9%)	165/499 (33.1%)
Underweight	8/22 (36.4%)	247/760 (32.5%)	8/74 (10.8%)	97/497 (19.5)

Overall malnutrition indices values were between those reported by Myanmar and by Thailand in the 2009 UNICEF "state of the world's children" report[12] (**Fig. 4**). However wasting was 3 times higher than what was found among the children of the displaced population living in the camps.

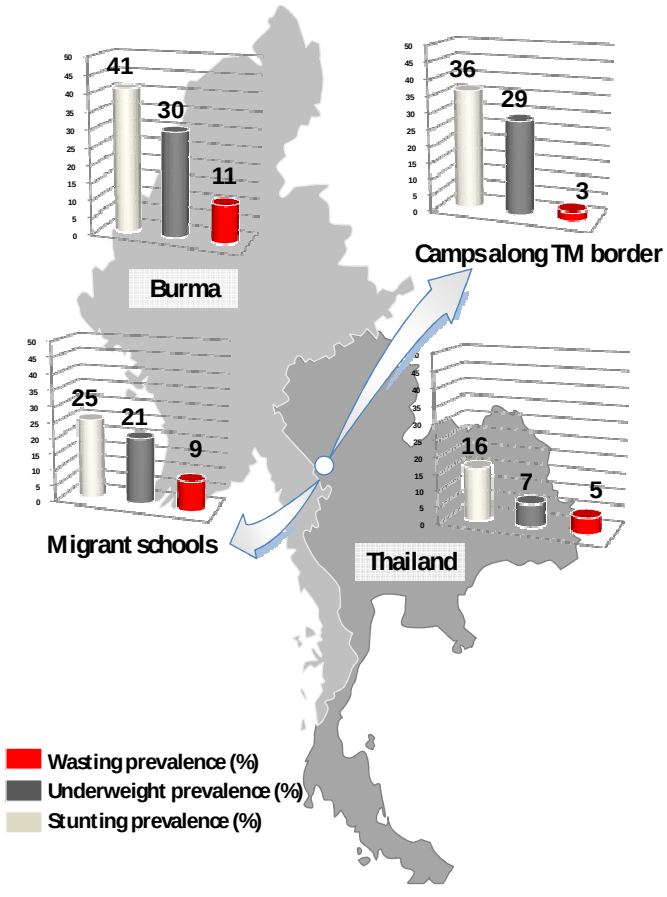

Fig.4. Prevalence of wasting, underweight and stunting in 0-59 months old by site

[12] UNICEF. The state of the world's children, special edition, statistical tables, table 2: nutrition. UNICEF. 2009.

DISCUSSION

This report presents what we believe is a first evaluation of children from migrant Burmese workers living in Tak province. The other published data on nutritional status of children of migrant workers was reported by Ditton *et al*. in 2009 among a migrant population living in Kanchanaburi province (South of Tak province): the reported underweight prevalence among 27 children aged 0-59 month old was 26%[13].

Prevalence of stunting and underweight in 0-59 month old children enrolled in the vaccine program was similar to Ditton's and to that recorded in Maela and Umpiem camps. It was slightly less than in Burma, a country listed by UNICEF among the 24 countries with the worst burden of stunting, alongside with nations like India, Nepal or Sudan[14] but still twice as high than values reported among children living in Northern Thailand less easily reached by national programs[15].

While chronic malnutrition is influenced by a various combination of long-term food deficiency, poor quality diet, and low economic status, acute malnutrition is mainly attributable to illness and/or shortage of food[16]. Luckily the recent measles and varicella zoster outbreaks in four of the schools did not affect the prevalence of wasting, which overall was close to the one described by Burma where the severity of wasting is considered as serious[17]. Although this rate is not ranked amongst the worst in Asia, it is close to prevalence rates found in Pakistan (13%) or Nepal (12%) and higher than those reported by countries like Lao PDR (7%) or Cambodia (6%)[18]. Interestingly however, severe wasting was rare and none of the children considered severely wasted by weight-for-height z-score had a MUAC less than 11.5cm, indicating that surveys using exclusively MUAC for detecting severe acute malnutrition in this area might be of little use. Also, wasted children were not seen in almost half of the schools surveyed; and among

[13] Ditton MJ, Lehane L. Towards realizing the health-related millennium development goals for migrants from Burma in Thailand. J Emp Res Hum Res Ethics 2009; 1556: 37-48.
[14] UNICEF. Tracking progress on child and maternal nutrition; a survival and development priority. UNICEF 2009.
[15] Office of the National Economic and Social Development Board.Thailand Millenium Development Goals Report 2004. Bangkok 2004.
[16] Nutrition Survey Procedures for Refugee Camps on the Thailand Burma Border. Thailand Burma Border Consortium (TBBC). Bangkok Thailand; 2007.
[17] Fernandez I.D, Himes J.H, de Onis M. Prevalence of nutritional wasting in populations: building explanatory models using secondary data. Bull WHO. 2002; 80: 282-291.
[18] UNDATA. The State of the world's children. Prevalence of wasting by country. UNICEF 2009.Available from: http://data.un.org/Data.aspx?d=SOWC&f=inID%3A108

schools where wasted children were present the prevalence range varied greatly independently of the location or the size of the school.

The nutritional situation of those children is somehow different from that of the children living in refugee camps. The food supply for those with a refugee status is regular and within the minimum daily allowance requirement in terms of proteins and calories. Access to health care and to therapeutic feeding programs is free, immunization coverage excellent. Although prevalence of stunting and underweight in the camps still reflect the situation encountered in Burma, acute malnutrition has almost disappeared from the camps. The migrant school feeding programs rely on NGOs or individual donors and there is no system in place to ensure continuity.

Since the start of the project in June 2009, a third of the schools providing free meals have stopped their feeding program and students have to rely on food brought from home. Unsurprisingly school attendance dropped after feeding programmes stopped; for example, attendance dropped by 40% after free meals stopped in one of the largest school (circa 100 students). Teachers report that not all children bring food from home, resulting in children not eating lunch at school and when the schools send the children home during lunch time food might not always readily available if both parents work. Although we haven't been able to see a difference in wasting and underweight prevalence between schools providing free meals and those which did not at the time of enrollment in the vaccination campaign, it will be interesting to compare the weight gain of children still enrolled in the vaccine campaign 6 months later.

Nutrition interventions vary according to the type of malnutrition and the severity of it. Acute malnutrition often requires hospitalization and strict medical care; chronic malnutrition on the other hand can be reduced by interventions improving the diet, or the feeding practices, providing nutrition and health education[19]. Thailand has a successfully reduced the underweight prevalence of its under-5 year old population by developing interventions such as the "School Lunch Program" which started in 1992[20]. In addition to school feeding programs, other interventions have been proposed to reduce the burden of disease and improve child health at

[19] Nutrition Survey Procedures for Refugee Camps on the Thailand Burma Border. Thailand Burma Border Consortium (TBBC). Bangkok Thailand; 2007.
[20] Thailand Country Profile. United Nations 2007. Available from: http://www.un.or.th/thailand/index.html, and Manual of Operations. FIVIMS Thailand. 2004. Available from: http://nutrition.anamai.moph.go.th/temp/pdf/fiv1.pdf

low cost i.e. school health programs which aim to eliminate worm infections and micronutrient deficiencies as well as providing health education at the same time[21].

It could be potentially possible to reduce the prevalence of underweight among children attending school for migrants by implementing nutritional package activities in those centers. However, there are several things to consider before introducing such programs; the prevalence of wasting among the under-5 years old was not negligible, but children suffering from acute malnutrition often demand medical care as well as supplementary feeding. Furthermore those children were unevenly spread in the schools surveyed and without definite pattern for a targeted intervention to take place. On the other hand, the success of school programs in reducing malnutrition among children depends on its sustainability. Children from migrant workers are unlikely to stay for several years in the same school and although they will benefit of at least one proper daily meal while at school, the overall effectiveness of the program will still be debatable. Migrant schools in Tak province, independently of their size, act as child protection centers, orphanages and day care centers which was the reason why a relatively high number of 0-59 month old children were screened. Malnutrition among older children was more difficult to evaluate as there are no comparative data available for this age group. However underweight and thinness prevalence were surprisingly high, suggesting that older children might also suffer of nutritional deficiencies although severe thinness was rare. There are several nutrition interventions for school age children that have shown a positive effect on eating behavior, but whether nutritional interventions for older children already undernourished are as effective has to be taken into consideration as well.

[21] The World Bank. World Development Report 1993: Investing in Health. New York: Oxford University Press, Inc.; 1993.