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and International Reference Standards:
Issues and Implications**

by

Wilma L. Molano, Allan A. Gulles and Jeffrey Y. de Leon

Author's name	:	Wilma L. Molano
Designation	:	Supervising Science Research Specialist
Affiliation	:	Food and Nutrition Research Institute – Dept. of Science and Technology
Address	:	Gen. Sanbs Ave., Bicutan, Taguig Clty
Tel. no.	:	(0632) 839-1843
E-mail	:	wilmamolano@yahoo.com
Co-author's name	:	Allan A. Gulles / Jeffrey Y. de Leon
Designation	:	Science Research Specialist I / Science Research Specialist I
Affiliation	:	Food and Nutrition Research Institute – Dept. of Science and Technology
Address	:	Gen. Santos Ave., Bicutan, Taguig Clty
Tel. no.	:	(0632) 839-1843
E-mail	:	a_gulles@yahoo.com , jeffdeleon26@yahoo.com

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ABSTRACT

As a signatory to the Millennium Summit in 2000, the Philippine government is committed to measure and monitor the eight Millennium Development Goals (MDGs). In monitoring one of the indicators, that is, the prevalence of underweight children under-five years of age, the Food and Nutrition Research Institute of the Department of Science and Technology (FNRI-DOST) regularly conducts Anthropometric Survey to collect height and weight data and assess nutritional status using the WHO-NCHS International Reference Standards (IRS). The WHO NCHS IRS is a useful tool in monitoring the growth of under-five children. This tool is currently used by nutrition workers up to the barangay level. However, since 2006, the WHO is encouraging the use of a new standard, the WHO Child Growth Standards or MGRS (i.e., Multicentre Growth Reference Study). Hence, it is deemed necessary to come up with a study on the effect on the prevalence of malnutrition data using the WHO MGRS versus the IRS. It will determine the prevalence of malnutrition among under-five children using the WHO MGRS and the WHO NCHS IRS, and identify the issues and implications in shifting from the IRS to MGRS. The study made use of the database of the 6th National Nutrition Surveys, particularly the Anthropometric Survey component among under-five children (N=3499). Descriptive statistics were used in coming up with the presentation of prevalence of malnutrition using the WHO MGRS and IRS. Review of literature as well as minutes of meetings of the constituted Technical Working Group that reviews the use of WHO MGRS form as part of this report. The study revealed that there is a decrease on the prevalence of underweight among under-five children from 26.8% to 20.7% in using the IRS and MGRS, respectively. On the other hand, an opposite trend was reflected for the prevalence of short and thinness. Majority (92.1%) of the under-five children have the same nutritional status using the weight-for-age index for both IRS and MGRS. In the case of height-for-age index, 94.5% of the under-five children had the same nutritional status for both IRS and MGRS. For the weight-for-height index, 97.7% of the under-fives were classified to have the same nutritional status for both IRS and MGRS. The paper will discuss the issues and implications using the MGRS.

1. Introduction

1.1 Background Information

The Philippine government, as a signatory to the Millennium Development Summit in year 2000 is committed to measure and monitor the eight Millennium Development Goals (MDGs), comprising of a total of 18 targets and 28 indicators. One indicator is the prevalence of malnutrition among under-five year old children. The government institution which has the mandate of monitoring the nutritional status of the population is the Food and

Nutrition Research Institute of the Department of Science and Technology (FNRI-DOST). FNRI-DOST conducts regular Anthropometry Survey every two to three years. It uses the World Health Organization-National Center for Health Statistics (WHO-NCHS) International Reference Standard (IRS) to monitor the growth of under-five year old children. However, experts on anthropometry identified some flaws on the current IRS. Thus, the introduction of a new standard -- the WHO Child Growth Standards or the Multicentre Growth Reference Study (MGRS) in 2006 was suggested. However, shifting of standards is a process that first needs assessment of its effects, issues and implications on policy formulation. Hence, this study was conducted.

1.2 Objectives

The general objective of the study is to analyze the effect of using either the WHO-MGRS reference or WHO-NCHS-IRS standard on the prevalence of malnutrition among under-five year-old children. Specifically, it aims to:

1. To determine/estimate the prevalence of malnutrition among under five years children, using the WHO-MGRS reference or WHO-NCHS-IRS standard; and
2. To identify the issues and implications in shifting from the WHO-NCHS-IRS standard to the WHO-MGRS reference.

2. Definitions and Explanatory Notes

Height-for-Age – an indicator that is used to determine past or chronic nutritional status where the child's actual height/length falls below this standard or reference height/length for his age. If the child's height/length falls below this standard or reference height/length, the child is underheight. Height-for-Age is the indicator used for children, two years old and above, while (recumbent) length-for-age is the indicator used for children below two years old (0-23 months).

Overweight and Obesity – conditions where a person's weight is much greater than that of a normal person of the same age (in the case of children) or height (in the case of adults).

Short – a condition where the child's height is lower than that of a normal child of the same age. It is measured using height-for-age as an index. It indicates chronic or long-standing malnutrition.

Thinness – a condition where the child's is lower than that of the normal child of the same height. It is measured using weight-for-height as index. It indicates acute malnutrition.

Underweight – a condition where the child's physical measurement or weight relative to age is lower than that of a normal child. It is measured using weight-for-age as an index. It indicates current malnutrition.

Weight-for-Age – the simplest and most common indicator for the assessment of growth. It compares the weight of the individual to a standard or reference weight-for-age. This indicator is useful for rapid screening because it combines acute and chronic malnutrition.

WHO-Multicentre Growth Reference Study (WHO-MGRS) – was undertaken between 1997 and 2003 to generate new curves for assessing the growth and development of infants and young children around the world. It collected primary data and related information from approximately 8,500 children from widely different ethnic backgrounds and cultural settings (Brazil, Ghana, India, Norway, Oman and the USA).

WHO-NCHS International Reference Standard (WHO-NCHS IRS) – a reference data for height and weight of children in the USA, originally collected by the NCHS and presently recommended for international use by the World Health Organization (WHO).

3. Methodology

3.1 Data Source

The study made use of the data provided by the 6th National Nutrition Survey (NNS), specifically those pertaining to its Anthropometric Survey among 0-4 years old children component. It employed the sampling technique developed by the NSO for their 2003 FIES. The 6th NNS considered 17 regions of the country and all its provinces, except for Batanes.

The first sampling stage was the selection of primary sampling unit (PSU), that either consisted of a barangay, or a group of contiguous barangays, in a municipality with at least 500 households. Secondly, enumeration areas (EAs) which consisted of approximately 150-200 households were selected from the obtained PSUs. For this stage, 813 EAs were determined. Lastly, selection of the ultimate sampling units, which are households, was done. With this, 50% of the total sample households from the 2005 FIES were selected per EA. All in all, 3,499 sample units were obtained.

3.2 Standard Errors and Coefficient of Variations

The standard error of an estimate helps to give sense of accuracy to the survey data in representing the whole population. Similarly, to determine the reliability and dispersion of the survey data, the coefficient of variation was considered. The acceptable level should be at 10% or lesser (Cochran, 1977).

3.3 Determining the Prevalence of Malnutrition by indices, using the IRS and MGRS

Malnutrition was determined by referring to indicators of underweight, underheight and thin. The classification cut-off points were shown in Appendix Table 1.

Meanwhile, in using the results of the 6th NNS Anthropometric Survey to determine the difference between using either IRS or MGRS, the estimates for each indicator (underheight, underweight, thinness) were cross-tabulated with each standard. From this, differences between estimates were computed and determined if significant at an acceptable level.

However, another way of analyzing the prevalence of malnutrition indicators was the determination of changes (increase or decrease) in prevalence of such indicators— if there is a shift from the use of the old IRS reference to the new MGRS standard. To do this, comparison of the percent distributions of underweight, underheight and thinness respectively should be done. From this, percent distributions of indicators correctly classified were known. On the contrary, the change (increase or decrease) on the prevalence of malnutrition indicators were determined by comparing the percent misclassified¹ values under each standard. With that:

IRS (%) > MGRS (%) = decline in the prevalence of a certain malnutrition indicator
IRS (%) < MGRS (%) = Increase In The Prevalence Of A Certain Malnutrition Indicator

4. Results And Discussions

4.1 Prevalence of Malnutrition using NCHS-IRS and WHO-MGRS

From Table 1, it can be seen that there has been a decrease in the prevalence of underweight from using IRS to MGRS by 6.1 percentage points (i.e., 26.8 - 20.7). On one

¹ For example, children are underweight if IRS reference was used, but not underweight if MGRS was used.

hand, 28.2% prevalence was seen under the IRS for underheight versus the 33.7 value under the MGRS standard. With that was the increase in the prevalence of underheight among 0-5 year old children. Prevalence of thinness however, was 5.7% by the IRS reference compared to 6.1% by the MGRS standard. This registered a 0.4 percentage point increase in the prevalence of thinness among the 0-5 year old population.

Table 1. Comparison of Anthropometric Standards from IRS and MGRS for children 0-4 years, Philippines, 2003

Indicator	IRS	MGRS	Direction
Underweight	26.8	20.7	?
Normal	71.9	78.1	?
Overweight	1.3	1.2	?
Stunted/Short	28.2	33.7	?
Normal	71.1	65.5	?
Tall	0.7	0.8	?
Wasted/Thin	5.7	6.1	?
Normal	91.9	91.3	?
Overweight-for-Height	2.0	2.4	?
NEC	0.4	0.2	?

Looking at Table 2, it can be seen that there is a significant difference in using either IRS reference or the MGRS standard when determining the prevalence of malnutrition, except for overweight-for-age.

Table 2. Estimates and SEs of Malnutrition, IRS and MGRS, 0-4 years old children, Philippines, 2003

	IRS		MGRS		Difference (IRS – MGRS)
	Estimate	S.E.	Estimate	S.E.	
Underweight	26.8	0.9	20.7	0.8	6.1*
Short	28.2	0.9	33.7	0.9	-5.5*
Thin	5.7	0.4	6.1	0.4	-0.4*
Overweight-for-Age	1.3	0.3	1.2	0.2	0.1

*Significant at $\alpha=5\%$

On the other hand, Table 3 showed that 92.1% of the sampled population were correctly classified using both the IRS and MGRS. When distributed, 72.3% are correctly classified as not underweight for both IRS and MGRS and 19.8% were underweight. This means that 72 out of 100 0-4 year old children are not underweight, while 20 out of 100 are underweight. Furthermore, the table also implied that a shift from IRS to MGRS resulted to a decline in the prevalence of underweight.

Table 3. Weight-for-Age of 0-4 year-old children, IRS versus MGRS, Philippines, 2003

0-4 years	MGRS		Total
	Not Underweight	Underweight	
IRS			
Not Underweight	72.3	0.9	73.2
Underweight	7.0	19.8	26.8
Total	79.3	20.7	100.0

Regarding the height-for-age index, 94.5% of 0-4 year old children had the same nutritional status across IRS references and MGRS standards. That is, prevalence of underheight was 66.3%, or 66 out of 100 0-4 year old children are not underheight, while 28.2% or 28 out of 100 0-4 children are underheight (refer to Table 4). Moreover, in changing from IRS to MGRS, a 5.5 percentage points increase in the prevalence of underheight children would be observed.

Table 4. Height-for-Age of 0-4 year-old children, IRS versus MGRS, Philippines, 2003

0-4 years	MGRS		Total
	Not Underheight	Underheight	
IRS			
Not underheight	66.3	5.5	71.8
Underheight	-	28.2	28.2
Total	66.3	33.7	100.0

Looking at the weight-for-height index, 97.7% of the samples were properly classified in using either the IRS or MGRS. In that, 92.9% or 93 out of 100 under-five children were considered as not thin and 4.8% or 5 out of 100 children were considered as thin (refer to Table 5). On the contrary, 2.3% were determined to be incorrectly classified using the IRS and MGRS standards. With that, there was a slight increase in the prevalence of thin 0-4 year old children when the MGRS standard was adopted.

Table 5. Weight-for-Height of 0-4 year-old children, IRS versus MGRS, Philippines, 2003

0-4 years	MGRS		Total
	Not Thin	Thin	
IRS			
Not Thin	92.9	1.3	94.2
Thin	1.0	4.8	5.8
Total	93.9	6.1	100.0

4.2 Distribution of Z-scores using NCHS and MGRS

The standards have an almost similar pattern of distribution, as shown by the shape of their graphs (refer to Figure 1). But it can be seen that there is a larger portion of the IRS' distribution belonging to the -2SD cut-off area, which is the indicator for underweight. With that, there is a higher prevalence of underweight 0-4 year old children when using the IRS, compared to MGRS.

Figure 1. Normal Distribution of Weight-for-Age by Standards, 0-4 years children

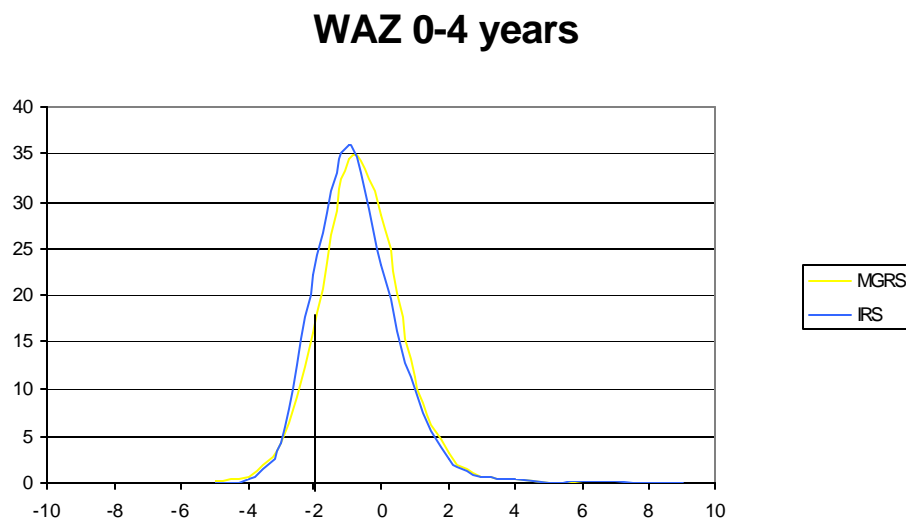
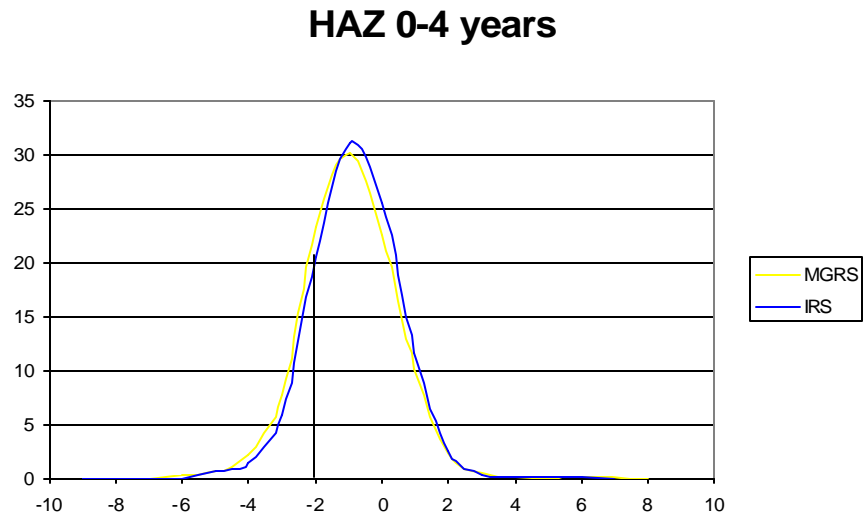


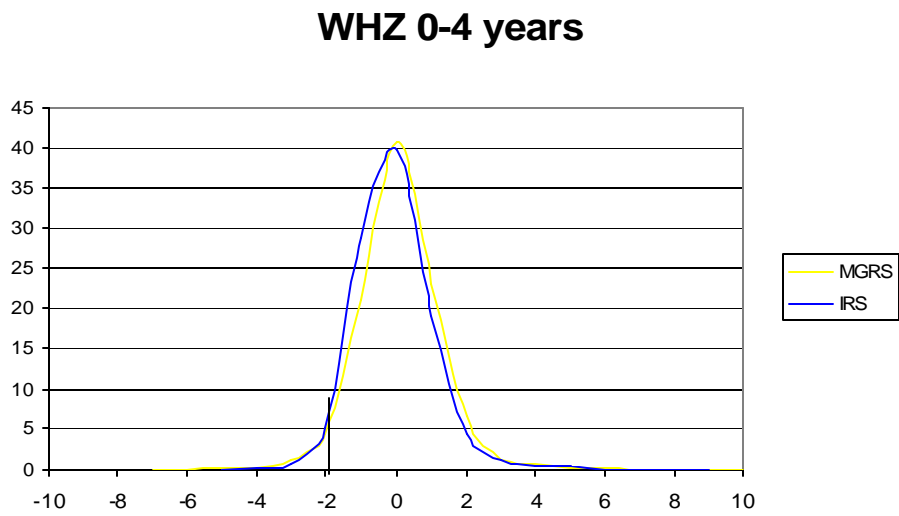
Figure 2 presents the distribution of height-for-age indices using the IRS and MGRS. From the figure, both standards seem to have nearly the same distribution. However, a higher prevalence of short is observed under MGRS. Comparing this with the results for the weight-for-age indicator, it could be implied that the MGRS standard is stricter or higher on height evaluation than on weight evaluation.

Figure 2. Normal Distribution of Height-for-Age by Standards, 0-4 years children



Like the former distributions, there is a smaller difference between the IRS and MGRS distributions for the weight-for-height indicator (refer to Figure 3). Nevertheless, a higher prevalence of thin under-five children is seen when MGRS is used.

Figure 3. Normal Distribution of Weight-for-Height by Standards, 0-4 years children



4.3 Why replace the IRS reference?: Limitations of the IRS reference

In recognition of the inadequacy of the IRS reference, the issue of the development and adoption of a better standard was seen as needed. With this, Wang et.al. (2006) cited the major limitations of the NCHS' IRS growth reference for children and adolescents:

1. Limitations of the reference population database
2. Methodological limitations.
3. New challenges and needs posted by the growing global obesity epidemic.
4. Inconsistency between pre-adolescents and adolescents.
5. Racial or ethnic differences and secular trends in growth and maturation patterns.
6. Uncertainty and inadequacy for assessing linear growth in adolescents.
7. Adjustment for between-population maturity differences.

Similarly, Butte et.al. (2006) analyzed the feasibility of developing a new growth standard for school-age children and adolescents based on identified IRS limitations like:

1. The IRS has an outdated basis.
2. The IRS was established from a limited sample of four separate sets of children and adolescents from the United States only.
3. IRS' reference for body weight possesses upward skewness, which causes a sizeable underestimation of obesity, particularly school-age children and adolescents.

4.4 Why use the MGRS Standards?: Features of the new WHO Child Growth Standards²

1. The new WHO Child Growth Standards show how every child in the world *should* grow.
2. The new standard is a technically robust tool to measure, monitor and evaluate the growth of all children worldwide, regardless of ethnicity, socio-economic status or type of feeding.
3. The standards are based on the breastfed infant as the normative growth model.
4. The Standards is an effective tool for detecting obesity.
5. The Standards provide all who aim to improve the health of children with a powerful advocacy tool.

4.5 Reference versus Standards

There is a difference between references and standards, though oftentimes, many interchange its use. Butte et. al. (2006) stated the WHO Expert Committee's concept of the

² Selection from the paper entitled Comparison of the New WHO Child Growth Standards and the National Center for Health Statistics-International Reference Standards, prepared by the National Nutrition Council (NNC)

reference as “a tool for grouping and analyzing data and for providing a common basis for comparing populations, but not for drawing inferences about the meaning of observed differences”. Equally, they furthered that a standard is something that “embraces the notion of a norm or desirable target, and this involves a value judgement”. For that reason, the committee stressed that “it is always desirable to choose references that most resemble true standards”.

4.6 Implications on the shift from IRS to MGRS

The Technical Working Group (TWG), on the analysis of the new WHO growth standards and its possible adoption has enumerated implications³ of MGRS adoption on policy formulation and program implementation:

1. Change in the magnitude of under- and overnutrition.
2. Requires investment for re-tooling of instruments and retraining of local field workers.
3. Requires the use of two kinds of reference standards.
4. Requires acquisition, revision and development of new tools and equipment.

5. Conclusions

Analyzing between the current IRS references and the new MGRS standards, effects on the prevalence of malnutrition (through different indicators such as height-for-age, weight-for-age and weight-for-height) were determined.

As for the outcomes of the study, it showed that the prevalence of underweight among 0-4 year old children will decrease by 6.1% in shifting from IRS to MGRS. However, the prevalence of short and thinness among under-five year old children will increase by 5.5% and 0.4%, respectively. It was observed that there isn't much difference in using either IRS or MGRS when determining the prevalence of thinness. But, it should also be noted that in adopting the MGRS, a 0.4% increase in the cases of overweight-for-age was revealed. Moreover, majority of the under-five years old sample population was properly classified.

Conversely, it can be said that MGRS is the better standard, since it set a benchmark for growth and development of 0-4 year old children regardless of ethnicity, gender and socio-economic status or type of feeding. More importantly, it was developed using standard feeding practices (exclusively breastfed infants up to 4 or 6 months, and given

³ Selection from the paper entitled Comparison of the New WHO Child Growth Standards and the National Center for Health Statistics-International Reference Standards, prepared by the National Nutrition Council (NNC)

complementary feeding after, breastfed up to 12 months). With that, the MGRS tell how children “should” grow and how they can achieve full growth potential. Secondly, the MGRS incorporated in its development, factors like nutrition, environment and healthcare, that have significant impacts on child growth. Moreover, the standard establishes a breastfed infant as the normative growth model, and thus recognizing the great benefits of breastfeeding for infants. Another advantage of the MGRS is its effectiveness in detecting obesity, compared to using the IRS.

Results of the study point out that in adopting the new standard (MGRS), there would be changes in the magnitude of under- and over-nutrition. MGRS is the standard considering the global infant and child recommendation of exclusive breastfeeding for first 6 months and continued breastfeeding up to 1 year. All of the children who are fed differently should be gauged based on this standard. Also, comparison between past data (which used IRS) and present data (using MGRS) would not be possible. In relation to this, currently, the MGRS standard is applicable only for the below 5 year-old population. An implication of this would be the use of two standards—the MGRS (if adopted) for the below 5 year old children, and the IRS for children beyond 5 years old. Additionally, a change from the IRS to MGRS would of course require investment for re-tooling of measurement instruments and other materials, and the re-training of field workers on how to use the new standards.

6. Recommendations

With the findings of the study, the use of the MGRS over the IRS in assessing the nutritional status of under-five year old children should be considered, since the latter has been proven to shortcomings in giving accurate and complete evaluations. It is also recommended to use MGRS to estimate overweight using a larger sample size, to subsequently recognize more of such rare cases. Moreover, for consistency of standards, the development of MGRS for the above-five year old population should be done for uniformity across different population age levels.

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Appendix Table 1. Cut-off points used in classifying nutritional status of children based on NCHS/WHO Reference Standards for Growth

Classification	Cut-off Points
<ul style="list-style-type: none"> • Weight-for-Age Underweight Normal Overweight 	<ul style="list-style-type: none"> <-2SD -2SD to +2SD >+2SD
<ul style="list-style-type: none"> • Height-for-Age Underheight/short Normal Above Average/Tall 	<ul style="list-style-type: none"> <-2SD -2SD to +2SD >+2SD
<ul style="list-style-type: none"> • Weight-for-Height Thin Normal Overweight 	<ul style="list-style-type: none"> <-2SD -2SD to +2SD >+2SD