Philippine Nutrition

Facts and Figures 2013

8th National Nutrition Survey

BIOCHEMICAL SURVEY

Food and Nutrition Research Institute
Department of Science and Technology
Bicutan, TaguigCity, Metro Manila

July 2015
Second Edition

ISSN 1655—2911
NNS 2015-B003

This report summarizes the results on the Biochemical Survey of the 8th National Nutrition Survey: Philippines, 2013 undertaken by the Food and Nutrition Research Institute, Department of Science and Technology (FNRI-DOST).

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Recommended Citation:

Food and Nutrition Research Institute-Department of Science and Technology (FNRI-DOST). 2015. *Philippine Nutrition Facts and Figures 2013: Biochemical Survey*. FNRI Bldg., DOST Complex, Bicutan, Taguig City, Metro Manila, Philippines. 2nd Edition.

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FOREWORD

As mandated in Executive Order No. 128 and 352, the Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST) incessantly conducts National Nutrition Survey (NNS) every five years to define the country's food, nutrition and health situation. However, over the years it has become more than just stating the nutritional status of Filipinos. It became a way of tracking the effectiveness of different installed programs and tracking progress towards the achievement of the Millennium Development Goals (MDG) and eradication of hunger, reduction of child mortality, improving maternal health and combating HIV/AIDS, malaria and other diseases.

The NNS serves as source of data and information for program and policy makers, both in private and public sectors. These are used as reference or basis in the preparation and development of interventions that would address the malnutrition problems in our country. This Facts and Figures on Biochemical Survey will be useful and informative to cause initiatives that would benefit the Filipino people; to help the authorities see how far their initial actions are reaching those in need and if they still need to extend their efforts further.

This Component of the Survey provides data on biochemical indicators that include anemia, vitamin A deficiency (VAD), and iodine deficiency disorder (IDD). For the first time, the survey included data on iron deficiency anemia (IDA), thalassemia and vitamin D deficiency in the National Capital Region (NCR) and selected provinces. The Second Edition of the Philippine Nutrition Facts and Figures 2013, Biochemical Survey Component include the prevalence of zinc deficiency.

We also hope that this book would serve as an eye-opener to program and policy makers, both in the private and public sectors and realize that our country is faced with triple burden of malnutrition: undernutrition, overnutrition and micronutrients deficiencies. Concerted efforts of government, private and non-government partners to join hands and converge resources to address the problems by evaluating whether existing interventions are really sensitive and specific towards reducing malnutrition, is needed.

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ACKNOWLEDGMENTS

The Food and Nutrition Research Institute gratefully acknowledges the following:

The National Statistics Office (NSO) for technical assistance by providing the sampling frame of barangays and household listings;

The Department of Interior and Local Government (DILG), Local Government Unit (LGU) and the Governors, Mayors and the Barangay (village) captains and their constituents for direct assistance in field survey operations;

The National Nutrition Council of the Department of Health (NNC-DOH) through its Regional Nutrition Program Coordinators (RNPCs) and Provincial/City and Municipal Nutrition Action Officers (PNAOs/CNAOs and MNAOs) for sharing their untiring guidance and incessant support during field data collection;

The Department of Science and Technology Regional Directors (RDs) and Provincial Science and Technology Directors (PSTDs) for their assistance especially in the recruitment of field staff, and conduct of training and pre-survey coordination in the regions;

The Department of Health (DOH) for financial assistance for the conduct of the survey on provincial UIE levels;

The Philippine Council for Health Research and Development (PCHRD), DOST for partial financial assistance for the conductof the thalassemia study;

The International Life Science Institute, SoutheastAsian Region (ILSI-SEAR), Singapore for partial financial assistance in the conduct of the thalassemia study;

Fonterra Brands, DSM, Philippine Society of Endocrinology and Metabolism (PSEM) and Osteoporosis Society of the Philippines Foundation, Inc. (OSPFI) for financial assistance for the Vitamin D study;

Dr. Arturo Y. Pacificador, as statistical consultant, for the technical guidance in sampling design;

All the 35,825 households and their 172,323 individuals for their indispensable participation and utmost cooperation in the survey; and

All the FNRI technical and non-technical staff, local researchers, local survey aides and numerous others who have provided their inputs, involvement, and contribution to the fruition of the 8th National Nutrition Survey: Philippines, 2013.

LIST OF ACRONYMS AND ABBREVIATIONS

ARMM	Autonomous Region for Muslim Mindanao
ASIN	An Act Promoting Salt Iodization Nationwide and for Related Purposes
BL	Biochemical Laboratory
BR	Biochemical Researcher
CALABARZON	Cavite, Laguna, Batangas, Rizal, Quezon
CAR	Cordillera Autonomous Region
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
CV	Coefficient of Variation
DILG	Department of Interior and Local Government
ECLIA	Electro-chemiluminescence Assay
EQUIP	External Quality for Urinary Iodine Procedures
EA	Enumeration Areas
Hb	Hemoglobin
HPLC	High Pressure Liquid Chromatography
ICCIDD	International Council for the Control of Iodine Deficiency Disorder
ICSH	International Council for Standardization in Hematology
ID	Iron Deficiency
IDA	Iron Deficiency Anemia
IDD	Iodine Deficiency Disorder
IZiNCG	International Zinc Nutrition Consultative Group
IVACG	International Vitamin A Consultative Group
LL	Lower Limit
LFS	Labor Force Survey
MCV	Mean Cell Volume
MCH	Mean Cell Hemoglobin
MDG	Millenium Development Goal
MIMAROPA	Mindoro, Marinduque, Romblon, Palawan
NIST	National Institute of Standards and Technology
NNS	National Nutrition Survey
NSO	National Statistics Office
OD	Optical Density
OSPFI	Osteoporosis Society of the Philippines Foundation Incorporated
PSA	Philippine Statistics Authority

PSEM	Philippine Society of Endocrinology and Metabolism
PSU	Primary Sampling Unit
QC	Quality Control
RE	Retinol Equivalent
RNPC	Regional Nutrition Program Coordinator
RTK	Rapid Test Kit
SD	Standard Deviation
SE	Standard Error
SPSS	Statistical Package for the Social Science
SOCCSKSARGEN	South Cotabato, Cotabato, Sultan Kudarat, Saranggani and General Santos City
SRM	Standard Reference Material
UL	Upper Limit
UNICEF	United Nations Children's Fund
VAD	Vitamin A Deficiency
VITAL-EQA	Vitamin A Laboratory External Quality Assurance
WHO	World Health Organization

OPERATIONAL DEFINITION

Anemia is a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic needs. The most common cause of anemia is iron deficiency. But, it could also be due to other nutritional deficiencies (such as folate, vitamin B_{12} and vitamin A), inflammation, parasitic infections, and inherited or acquired disorders that affect hemoglobin synthesis, red blood cell production or red blood cell survival.

Ferritin is the iron storage protein. It is the most specific biochemical parameter that correlates with relative total body store.

Cyanmethemoglobin method is the gold standard for the quantitative determination of hemoglobin. This method entails dilution with a single reagent and measures all forms of circulating hemoglobin except sulfhemoglobin. It produces a relatively broad spectrum band at 540 nm and employs standard with exceptionally long stability.

Hemoglobin is the tetrameric protein that has heme and globin molecules whose function is to transport oxygen from the lungs to the tissues and of carbon dioxide in the reverse direction.

Hemoglobinopathy is a common genetic disorder of hemoglobin. Hemoglobinopathy includes all genetic haemoglobin disorders and is subdivided into two main groups: thalassemia syndromes and structural hemoglobin variants or abnormal haemoglobin.

Iodine Deficiency Disorder (IDD) refers to all of the ill effects of iodine deficiency in a population that can be prevented by ensuring that the population has an adequate intake of iodine-rich foods. It occurs when food intakes fall below recommended levels.

Iron Deficiency is a condition in which there are no mobilizable iron stores and signs of a compromised supply of iron to tissues are noted.

Iron Deficiency Anemia (IDA) is a condition where a lack of iron in the body leads to a reduction in the number of red blood cells, as reflected in low hemoglobin levels.

Retinol, also known as pre-formed vitamin A is an alcohol. It is the predominant circulating form of vitamin A in the blood. The retinyl ester derivative of the alcohol serves as the storage form of the vitamin in animals

Thalassemia occurs when gene defects cause hemoglobin synthesis disorders. Hemoglobin structure in these cases is normal but synthesis is limited. Abnormal (variant) hemoglobin results when gene defects cause changes in hemoglobin structure.

Vitamin A Deficiency (VAD) is the lack of vitamin A in the body. Vitamin A deficiency occurs where diets contain insufficient vitamin A for meeting the needs for growth and development, physiological functions and illness. VAD is the leading cause of preventable blindness in children and increases the risk of disease and death from severe infections.

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SUMMARY OF FINDINGS

The Biochemical component of the 8th NNS, included determination of prevalence of anemia, vitamin A deficiency (VAD), zinc deficiency and iodine deficiency disorder (IDD) for all ages and physiologic groups, on a national level. For IDD among school children, provincial estimates were determined. Thalassemia and iron deficiency anemia (IDA) were determined among the 6 years and over population and pregnant women in the National Capital Region (NCR) only. Vitamin D deficiency was determined among adults 20 years and over in the NCR and the provinces of Cagayan, Benguet, Cebu and Davao.

Over-all anemia prevalence in the Philippines has declined from 28.9% in 1993 to 11.2% in 2013. Highest prevalence was observed among the infants aged 6 months to less than one (1) year old at 40.5% which is considered a "severe" public health problem. Among the pregnant (24.6%) and lactating women (16.7%), anemia prevalence was still "moderate" and "mild" public health problem, respectively. Anemia prevalence was higher among the elderly (22.6%) and lactating women (20.0%) and the prevalence was higher in the rural areas than in the urban areas. On the other hand, anemia prevalence among pregnant women was higher among those in the urban areas (29.0%). Anemia prevalence was highest among the poorest quintile of infants 6 months to 5 years (16.5%), adults (10.9%) and the elderly (24.0%). Among the pregnant women, anemia was highest among the rich (32.0%).

In the NCR, 17.2% of anemic household members 6 years and over, had some form of hemoglobin disorder. The most frequent disorder was α-thalassemia at 13.9% while β-thalassemia was found in 1.6%.

In the NCR, iron deficiency anemia (IDA) was found in 54.7% of adolescents (13-19 years) and 54.4% of the adults (20 years and over). Among the pregnant women, IDA was present in 70.9%.

Over-all, VAD prevalence was 6.2%. Among the preschool children, 6 months to 5 years, VAD is still a "severe" public health problem at 20.4%. The younger infants aged 6 months-< 1 year, had higher VAD prevalence at 27.9%, compared to the older infants aged 1 to 5 years at 19.6%. Among the pregnant and lactating women, VAD was 9.0% and 6.4%, respectively. By place of residence, there was no VAD difference among the children in the urban compared to those living in the rural areas. Among the pregnant women, VAD was higher for those in the urban compared to those in the rural areas. It is the opposite for the lactating mothers, as those in the rural areas had higher VAD than those in the urban areas.

Over-all, mean vitamin D levels were highest among the adults from Cagayan (107.8±3.6 nmol/mL) and lowest for the adults from Benguet (73.3±1.3 nmol/mL), for all age and sex groups. Males had higher vitamin D levels compared to their female counterparts. There were more deficient and insufficient levels among the females compared to the males. The highest proportions of deficient and insufficient levels were found among the adults from Benguet (60.3%) and the lowest were among the adults from Cagayan (19.5%). Highest proportion of deficient and insufficient levels was among the females 20-39 years old.

The over-all prevalence of zinc deficiency is 25.6%, which is considered a "high" public health concern. Highest prevalence of deficiency was observed among the elderly, aged 60 years and above at 36.3%, followed by the adults 20-59 years and the lactating women at 28.1% and 25.2% respectively. Lowest prevalence of zinc deficieny was recorded among the pregnant women at 13.7% followed by the preschool children at 17.9%. Prevalence of deficiency among the elderly, adults, and lactating women, as well as that of the school children and adolescents is considered a "high" public health concern, while that of the pregnant women and pre-school children was "moderately high".

Iodine status of school children, aged 6 – 12 years old, is now optimal although pockets of deficiency still exist. Two (2) or 2.4% of the provinces (Zamboanga del Norte and Guimaras) had "moderate" IDD and 11 or 13.1% of the provinces had mild IDD. For the regions, lowest levels were found in the Zamboanga Peninsula. IDD was still seen among the elderly (Median UIE = 80 ug/L), pregnant (Median UIE = 105 ug/L) and lactating (Median UIE = 77 ug/dL) women. Similar to that of the school children, IDD among these groups was highest in Zamboanga Peninsula. Median UIE levels in the urban and rural areas for the pregnant and lactating women and the elderly were below optimal levels indicating the presence of IDD. The median UIE was were lower in the rural areas than in the urban areas.

Results of the 2013 NNS show a trend towards lower anemia and VAD prevalence among Filipinos. Zinc deficiency is a problem of public health concern especially among the elderly. Iodine nutrition among school children corresponded to adequate iodine intakes. On the other hand, IDD was still present among the pregnant and lactating women and the elderly. Of the five provinces, where vitamin D status was determined, deficincey was highest in Bontoc and lowest in Cagayan.

1. INTRODUCTION

Direct nutritional assessment of human population groups includes Anthropometry, Clinical and Biochemical surveys. Generally, intricate biochemical tests are costly and time consuming to carry out. But the importance of such biochemical tests of nutritional significance is necessary in order to determine the levels of adequacies or deficiencies of some important nutrients in the body before sub-clinical levels or clinical signs of deficiency become evident.

The 8th NNS's Biochemical Survey Component provides data on biochemical indicators that include anemia, iron deficiency anemia (IDA), thalassemia, vitamin A deficiency (VAD), zinc deficiency, vitamin D deficiency, and iodine deficiency disorder (IDD).

Anemia is a public health problem globally as reported by WHO (2015). The highest prevalence was among the children 6 months to 5 years at 42.6% (95% CI: 37 - 47). Among the women of reproductive age (WRA) aged 15-49 years, it was 29.4% (95% CI: 24.5 - 35.0). In addition, the global prevalence of anemia for pregnant women was 38.2% (95% CI: 33.5 - 42.6). Anemia adversely affects cognitive and motor development, cause fatigue and low productivity. During pregnancy, it may be associated with low birth weight and increased risk of maternal and perinatal mortality.

According to the World Health Organization, vitamin A deficiency is a public health problem affecting about one third of children aged 6 to 59 months in 2013, with the highest rates in sub-Saharan Africa (48%) and South Asia (44%). Based on serum retinol concentrations, most vitamin A-deficient children live in South-East Asia where 91.5 million preschool children had concentrations <0.70 μmol/L, or <20 μg/dL (WHO, 2009). VAD is associated with morbidity in children and the leading preventable cause of childhood blindness. It also leads to xerophthalmia, anemia, increased susceptibility to infections, growth retardation and risk of death.

Worldwide, an estimated 1 billion people have inadequate levels of vitamin D in their blood. Studies suggest that roughly about 30–50% of the adult populations are at risk of vitamin D deficiency (Holick MF 2014). Vitamin D has been associated with important short- and long-term health effects, including rickets and osteomalacia and the risk of osteoporosis and common chronic diseases such as diabetes, cardiovascular diseases and cancer.

Very few countries have data on serum zinc levels as indicator of zinc status in populations. As indicator of deficiency, Wessells and Brown (2012), used zinc intake and stunting to estimate global deficiency. An estimated 17.3% of the world's population is at risk of inadequate zinc intake. The mean prevalence of stunting in countries identified as being at low, moderate and high risk of

inadequate zinc intake were 19.6%, 28.8% and 43.2%, respectively. Zinc deficiency results in growth retardation, delayed sexual maturity and increased susceptibility to infections. During pregnancy, severe zinc deficiency has been associated with spontaneous abortion and congenital malformations, while milder forms have been associated with low birth weight, intrauterine growth retardation and complications during labor and delivery.

IDD prevalence is decreasing globally. Based on median UIE levels of school-aged children as proxy indicator for the population, the number of iodine deficient countries has decreased from 54 in 2003, 47 in 2007, 32 in 2011 and 25 in 2014 (ICCIDD, 2015). Iodine deficiency is the leading cause of preventable mental retardation and impaired psychomotor function in young children. It results in a lower intelligence quotient (IQ). During pregnancy, it increases the risk of still birth and miscarriage. Irreversible impairment of brain development of the fetus occurs if there is iodine deficiency during the second and third trimester of pregnancy.

Major cause of micronutrient deficiencies is insufficient intake of the nutrient and presence of inhibitors of absorption, such as phytate for iron and zinc. Other causes include other micronutrient deficiencies, acute and chronic infections. Malaria, cancer, tuberculosis and HIV can cause anemia. As well, inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival (e.g. haemoglobinopathies) can cause anemia. Diarrhea, measles, and respiratory infections can cause VAD. The primary cause of vitamin D deficiency is lack of sunlight exposure.

This monograph includes results of anemia, VAD, zinc deficiency and IDD surveys. The determination of IDA, thalassemia and vitamin D deficiency are included for the first time. The survey for vitamin D covered adults, 20 years old and over, from selected households in the NCR. Vitamin D deficiency was also determined in Cebu, Davao del Sur, Benguet and Cagayan. The survey for iron deficiency anemia and thalassemia covered household members 6 years to the elderly and pregnant women also from the selected households of the NCR. Thalassemia was determined only from anemic individuals from the NCR.

2. METHODOLOGY

2.1 Sampling Design

The statistical design used in the Biochemical Survey component was a multi-staged stratified sampling design. The first stage of the sampling was the selection of the Primary Sampling Unit (PSU) which consisted of one barangay or a contiguous barangay with at least 500 households. The second stage was the selection of the Enumeration Area (EA) which consisted of contiguous area in a barangay with 150-200 households and the last stage was the selection of the households in the sampled EA that served as the ultimate sampling unit. The samples were taken separately from the regions by urban and rural stratum.

About 35,825 sample households were selected for the survey. The survey lasted from June 19 to December 4, 2013 and continued on February 16 to April 15, 2014. The details of the sampling design are discussed in the Overview Module of the Facts and Figures, 2013.

2.2 Scope and Coverage

The National Nutrition Survey (NNS) covered 17 Regions which consisted of 80 provinces including NCR. However, Batanes was excluded for logistic reasons. The 2013 NNS used the Philippine Statistics Authority (PSA) (formerly the National Statistics Office, NSO) Master Sample (MS) which utilized the 2009 Labor Force Survey (LFS) Households.

The Biochemical Component of the survey covered 100% of one (1) replicate of the NNS generating national estimates, except for the IDD survey of schoolchildren aged 6 to 12 years, where all households from the 4 replicates of the master sample were covered, generating provincial estimates. The thalassemia and IDA surveys covered NCR households only. The vitamin D survey covered the NCR and the provinces of Cebu, Davao, Cagayan and Benguet. Table 1 summarizes the target age/physiological groups for the specific measurements.

Table 1. Target age and physiological groups for the different biochemical measurements

PARAMETERS	AGE/PHYSIOLOGIC GROUPS						
	6 mos - 5 yrs	6 - 12 yrs	13 - 19 yrs	20 - 59 yrs	≥ 60 yrs	Pregnant women	Lactating mothers
Anemia	✓	✓	✓	✓	✓	✓	✓
Thalassemia		✓	✓	✓	✓	✓	
Iron Deficiency Anemia (IDA)		✓	✓	✓	✓	✓	
Vitamin A Deficiency (VAD)	✓	✓	✓	✓	✓	✓	✓
Zinc Deficiency	✓	✓	✓	✓	✓	✓	✓
Vitamin D Deficiency				✓	✓		
Iodine Deficiency Disorder (IDD)		✓	✓	✓	✓	✓	✓

On the average, response rate for the anemia survey was 85.7%. It was lowest among the infants 6 months - <1year old and highest among the lactating women (Table 2). Response rate for the thalassemia study was 86.1% for the 6-12 year old children; 13-19 year old adolescents, 20-59 year old adults and the pregnant women all had response rates > 90.0% (Table 3). The over-all response rate for vitamin A was 85.1%. It was lowest among the infants 6 months - < 1 year at 71.8% and highest among the lactating mothers at 92.4% (Table 4). For vitamin D, response rates were 89.1% for NCR, 89.4% for Cagayan, 87.9% for Benguet, 86.4% for Cebu and 90.6% for Davao (Table 5). Response rate for zinc was 71.6% for the children 6-5 years, 86.6% for the children 6-12 years and 86.2% for the adolescents 13-19 years. It was 87.3% and 92.7% for the pregnant and lactating women, respectively (Table 6).

For the UIE survey, over-all response rate was 92.2%. Across age and physiologic groups, response rate was all above 90% (Table 7).

Table 2. Response rate for anemia

Age/Sex Physiologic State	Number of Eligibles	Total number of responses	Response Rate (%)
Children			
6 mos – 5 y	4,367	3,190	**73.0**
6 – 12 y	6,661	5,794	**87.0**
13 – 19 y	6,259	5,500	**87.9**
Adult			
20 – 59 y	16,851	14,665	**87.0**
≥ 60 y	4,185	3,664	**87.1**
Pregnant women	354	310	**87.6**
Lactating women	804	749	**93.2**
Philippines	**39,481**	**33,852**	**85.7**

Table 3. Response rate for thalassemia: National Capital Region

Age/Sex Physiologic State	Number of Eligibles	Total number of responses	Response Rate (%)
Children			
6 – 12 y	495	426	**86.1**
13 – 19 y	482	440	**91.3**
Adult			
20 – 59 y	1,365	1,255	**91.9**
Pregnant women	25	24	**96.0**

Table 4. Response rate for Vitamin A Deficiency

Age/Sex Physiologic State	Number of Eligibles	Total number of responses	Response Rate (%)
Children			
6 mos – 5 y	4,370	3,139	**71.8**
6 – 12 y	6,662	5,752	**86.3**
13 – 19 y	6,259	5,463	**87.3**
Adult			
20 – 59 y	16,860	14,589	**86.5**
≥ 60 y	4,189	3,619	**86.4**
Pregnant women	354	309	**87.3**
Lactating women	804	743	**92.4**
Philippines	**39,498**	**33,614**	**85.1**

Table 5. Response rate for Vitamin D Deficiency

Age/Sex Physiologic State	Number of Eligibles	Total number of responses	Response Rate (%)
NCR	**1,623**	**1,446**	**89.1**
20 – 59 y	1,366	1,205	**89.5**
≥ 60 y	277	241	**87.0**
Cagayan	**339**	**303**	**89.4**
20 – 59 y	265	237	**89.4**
≥ 60 y	74	66	**89.2**
Benguet	**248**	**218**	**87.9**
20 – 59 y	190	168	**88.4**
≥ 60 y	58	50	**86.2**
Cebu	**712**	615	**86.4**
20 – 59 y	573	502	**87.6**
≥ 60 y	139	113	**81.3**
Davao	**669**	**606**	**90.6**
20 – 59 y	579	518	**89.5**
≥ 60 y	90	88	**97.8**

Table 6. Response rate for Zinc Deficiency

Age/Sex Physiologic State	Number of Eligibles	Total number of responses	Response Rate (%)
Children			
6 mos - 5 y	4,370	3,124	**71.5**
6 - 12 y	6,662	5,761	**86.5**
13 - 19 y	6,259	5,392	**86.2**
Adult			
20 – 59 y	16,863	14,496	**86.0**
≥ 60 y	4,189	3,604	**86.0**
Pregnant women	354	309	**87.3**
Lactating women	804	748	**93.0**
Philippines	**39,501**	**33,434**	**84.7**

Table 7. Response rate for Iodine Deficiency Disorder

Age/Sex Physiologic State	Number of Eligibles	Total number of responses	Response Rate (%)
Children			
6 - 12 y	24,950	22,588	**90.5**
13 - 19 y	5,827	5,514	**94.6**
Adult			
20 – 59 y	15,850	14,820	**93.5**
≥ 60 y	3,960	3,676	**92.8**
Pregnant women	1,165	1,095	**94.0**
Lactating women	1,542	1,460	**94.7**
Philippines	**53,294**	**49,153**	**92.2**

2.3 Survey Methods

2.3.1 Blood Collection, Field Processing, Storage and Transport

Blood samples were collected by licensed and trained Medical Technologists (Figure 1). Blood samples were collected from the preschoolers by finger prick method using sterile contact activated blood lancets, while by venous blood collection from the other age and physiologic groups. Twenty (20) microliters of blood was directly pipetted into a cyanmethemoglobin solution for determination of hemoglobin.

Serum was separated from the red cells within two (2) hours after blood collection and transferred to a trace element free blue top tube (BD tube #369737). Serum was used for the determinations of ferritin, vitamin A, vitamin D and zinc. All blood collections were done inside rooms to avoid exposure of the collected specimen to direct sunlight. In the field, serum was kept frozen in freezers or in ice chests with dry ice. Blood samples were transported to the Biochemical Laboratory (BL) of FNRI in the frozen state. These were kept in -80^{o}C freezers until laboratory analysis was conducted.

In the NCR, where thalassemia and IDA were determined, a portion of the blood sample from household members 6 years and over were transferred to two (2) violet top tube with anticoagulant (BD #367841) and one trace element free blue top tube (BD # 369737). One (1) tube was brought to a 17025 ISO accredited pre-selected laboratory for determination of complete blood count (CBC) on the day of blood collection. The second tube was kept frozen at FNRI. After results of CBC were submitted to FNRI, the second tube with below normal levels of hemoglobin, mean cell volume (MCV) and mean cell hemoglobin (MCH) were also sent to the laboratory for determination of hemoglobinopathies by capillary electrophoresis. Serum from the blue top tube was stored in the freezer and was used for serum ferritin determination.

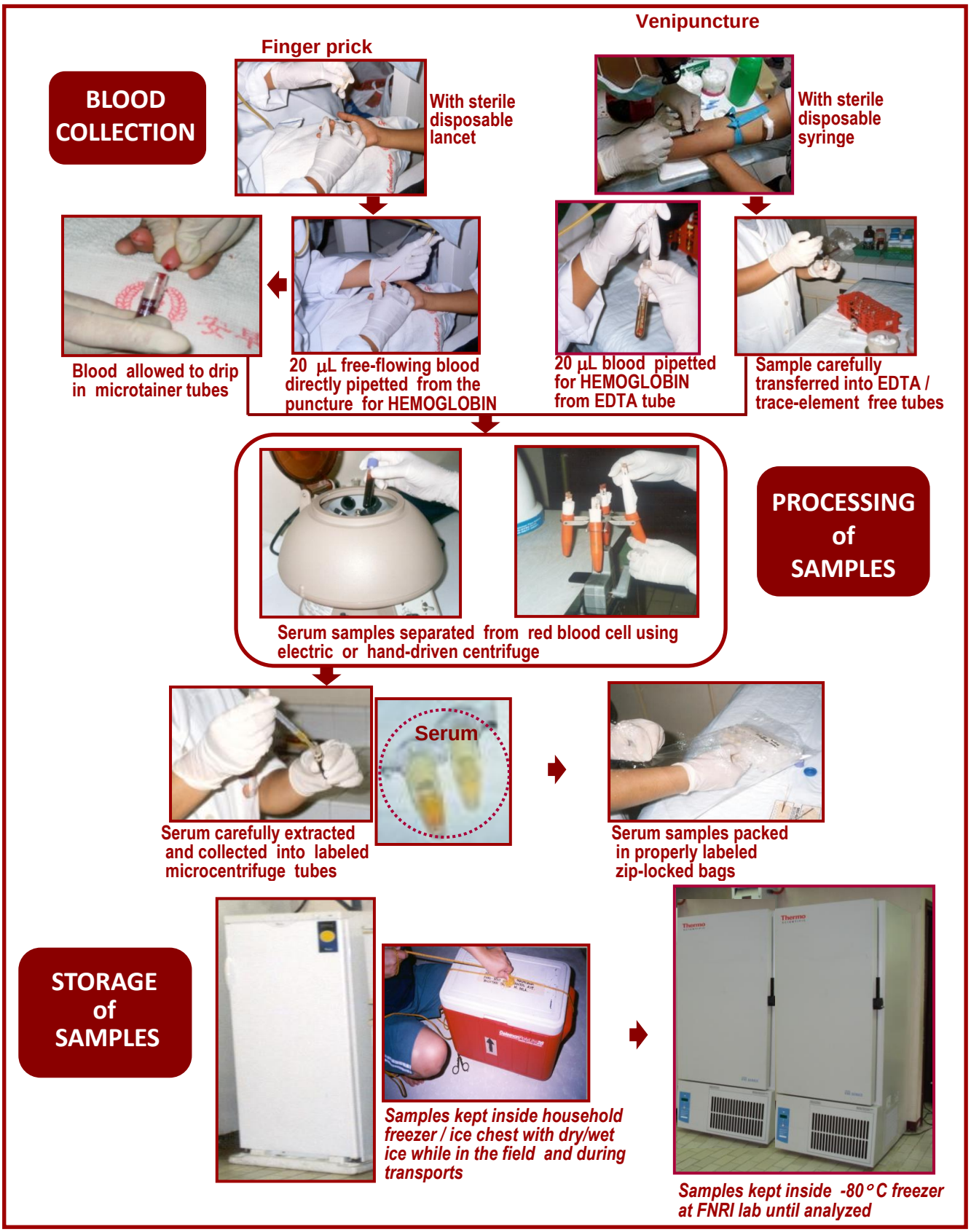


Figure 1. Blood collection, processing in the field, transport and storage at FNRI

2.3.2 Urine Collection, Field Storage and Transport at FNRI

About 15 mL mid-stream urine sample was collected from sample household members aged 6 years and over, pregnant and lactating women, for the determination of UIE level. These were kept in an ice chest in the field and while in transport to the FNRI BL. At the BL, the urine samples were stored in freezers (-20^0) until determination of UIE was conducted (Figure 2).

Figure 2. Urine collection, field storage, transport and storage at FNRI

2.3.3 Hemoglobin Determination

From the finger prick blood samples, 20µL of whole blood was pipetted directly into a tube containing 5 mL of cyanmethemoglobin solution. From the venous blood sample with an anticoagulant, 20 µL was likewise pipetted into a tube with 5 mL cyanmethemoglobin solution.

Hemoglobin was determined, from household members 6 months and above and pregnant and lactating women in the field, using the cyanmethemoglobin method (ICSH, 1978) (Figure 3 and Annex 1). A portable spectrophotometer was used for absorbance measurements. To monitor precision of hemoglobin determination in the field, each Biochem Researcher (Med Tech) had a pool of control blood and its concentration is determined together with the survey samples. The concentration of this pool of control blood was previously determined. Each researcher also had a tri-level control blood sample for measurement of accuracy.

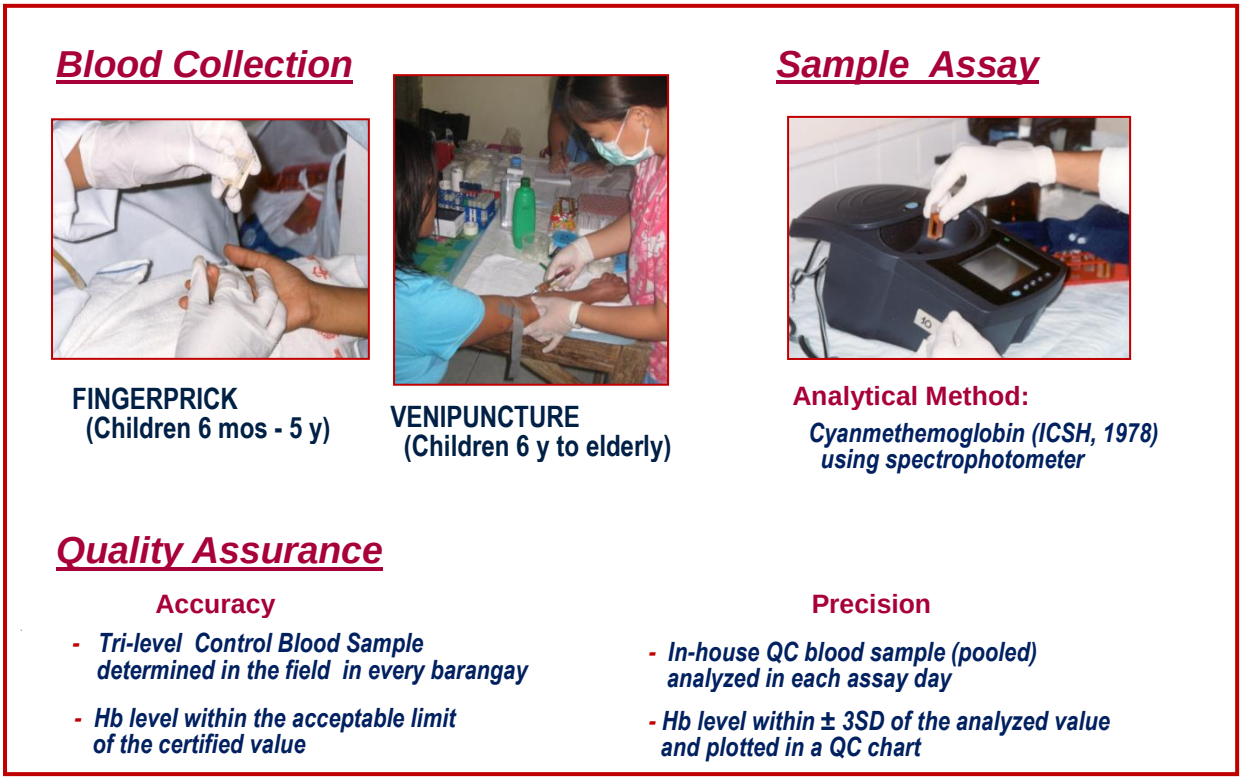


Figure 3. Blood collection and hemoglobin determination in the field by the cyanmethemoglobin method

2.3.4 Thalassemia Determination:

On the day of blood collection, plasma from household members from the NCR, aged 6 years and over, pregnant and lactating women were brought to a pre-selected ISO 15189 accredited laboratory for the determination of CBC using a Coulter Counter. Within one (1) week after blood collection, capillary electrophoresis was then conducted on samples with either below normal hemoglobin values, low MCV and low MCH for determination of thalassemia and other hemoglobinopathies. Hemoglobinopathies was determined using a Sebia Capillary System capillary zone electrophoresis (CE). This was also conducted by a pre-selected SO 15189 laboratory (Annex 2).

2.3.5 Iron deficiency anemia determination

Ferritin was determined for iron deficiency anemia. It was determined from blood samples in the "thalassemia" study. A commercially available RIA kit was used in the determination of ferritin (Annex 3).

2.3.6 Retinol Determination

Serum retinol was determined for vitamin A deficiency. Determinations were conducted at the Biochemical Laboratory (BL) of FNRI-DOST, by HPLC method (Furr et al 1992) (Figure 4 and Annex 4). For quality assurance, the BL participates in the Vitamin A Laboratory External Quality Assurance (VITAL-EQA) program of Centers for Disease Control and Prevention (CDC), Georgia, Atlanta, USA. A standard reference material (NIST 968c) was also used. Precision was established using a pool of serum whose concentration was previously determined.

2.3.7 Vitamin D Determination

Total serum 25-hydroxyvitamin D [(25-OH(D)] was determined for vitamin D deficiency. This was conducted by a pre-selected ISO 15189 accredited laboratory using Electro-chemiluminescence binding assay (ECLIA) method (Annex 5).

2.3.8. Zinc Determination

Serum zinc was analyzed by atomic absorption spectrometry (AAS) following the procedure of Smith et al, 1979 and Butrimovitz & Purdy, 1977 to determine zinc deficiency (Figure 5 and Annex 6). Accuracy was assessed using 2 Standard Reference Materials: the NIST SRM 1598a and Seronorm trace elements serum. Zinc concentration of the internal quality control pooled serum was determined after every 10 samples to monitor the precision.

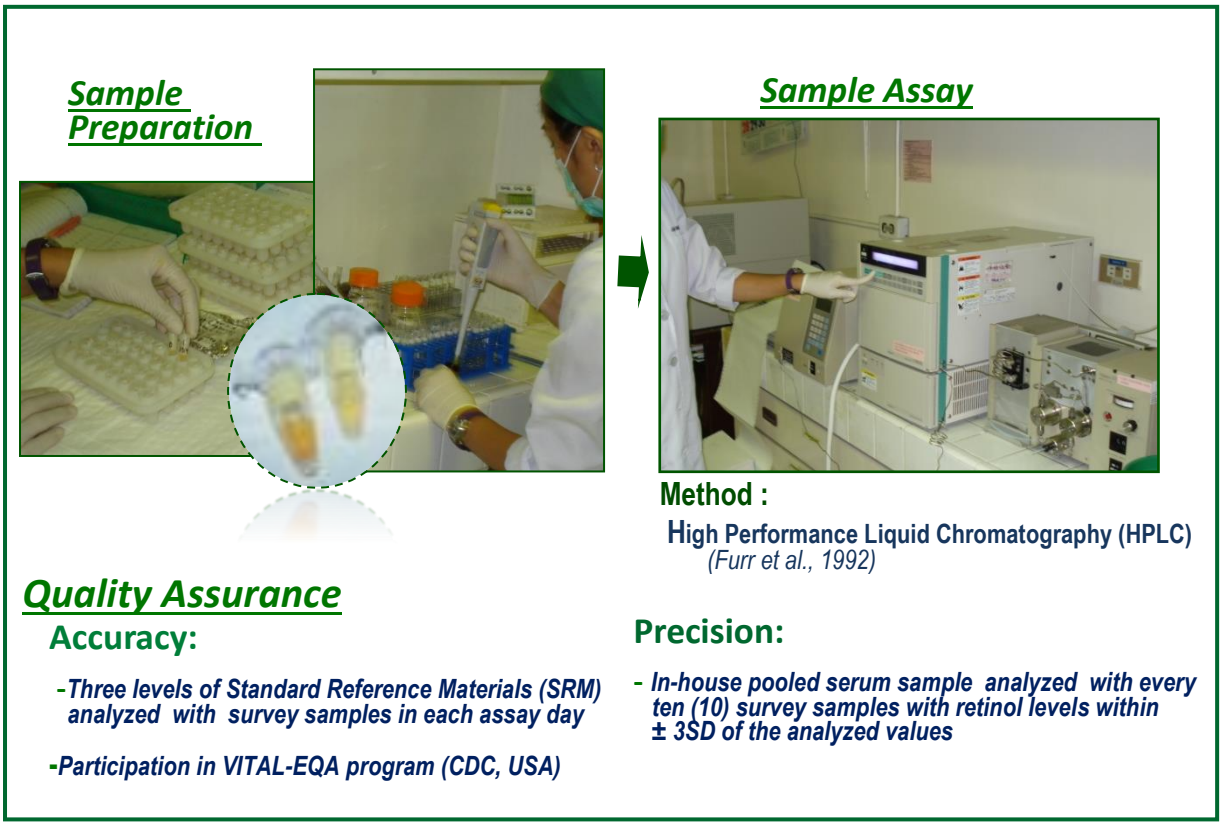


Figure 4. Retinol determination by High Pressure Liquid Chromatography (HPLC)

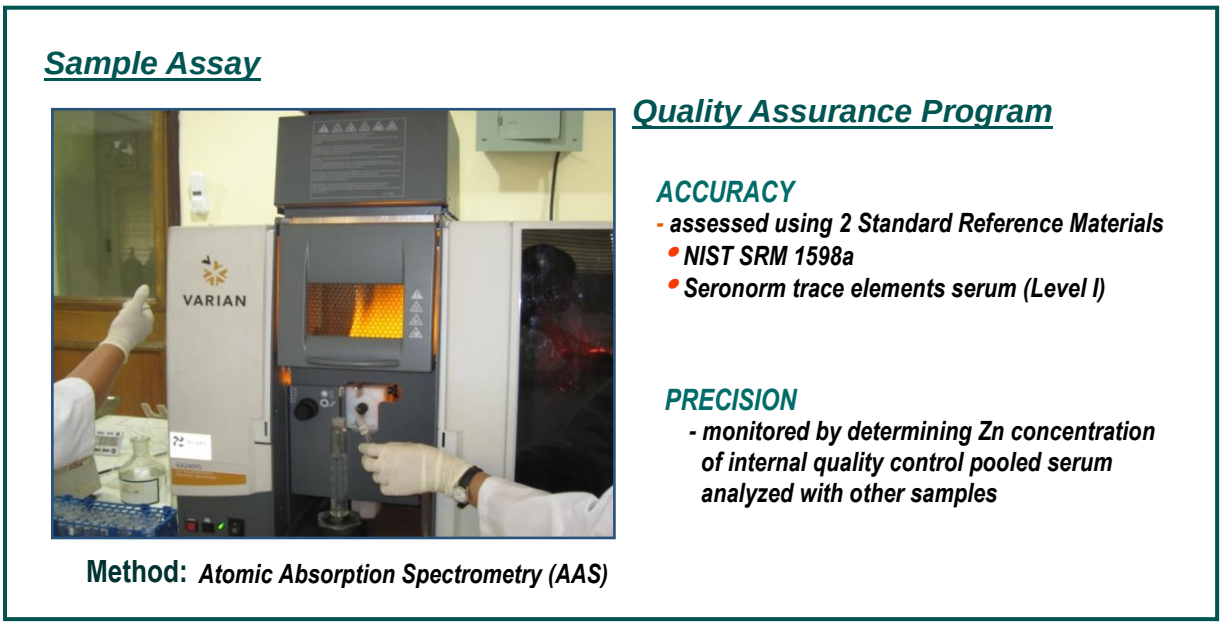


Figure 5. Serum zinc analysis by Atomic Absorption Spectrometry (AAS)

2.3.9 Urinary Iodine Excretion (UIE) Determination

UIE determination was conducted at the BL of the FNRI-DOST. The acid digestion method of Dunn et al (1993) was used to determine UIE concentrations (Figure 6 and Annex 7). For quality assurance, the BL participates in the Ensuring Quality of Urinary Iodine Procedures (EQUIP) program of CDC, in Atlanta, USA. For precision, a pool of urine was prepared and UIE level of the pool is determined together with the survey samples. The concentration of the urine pool has previously been established.

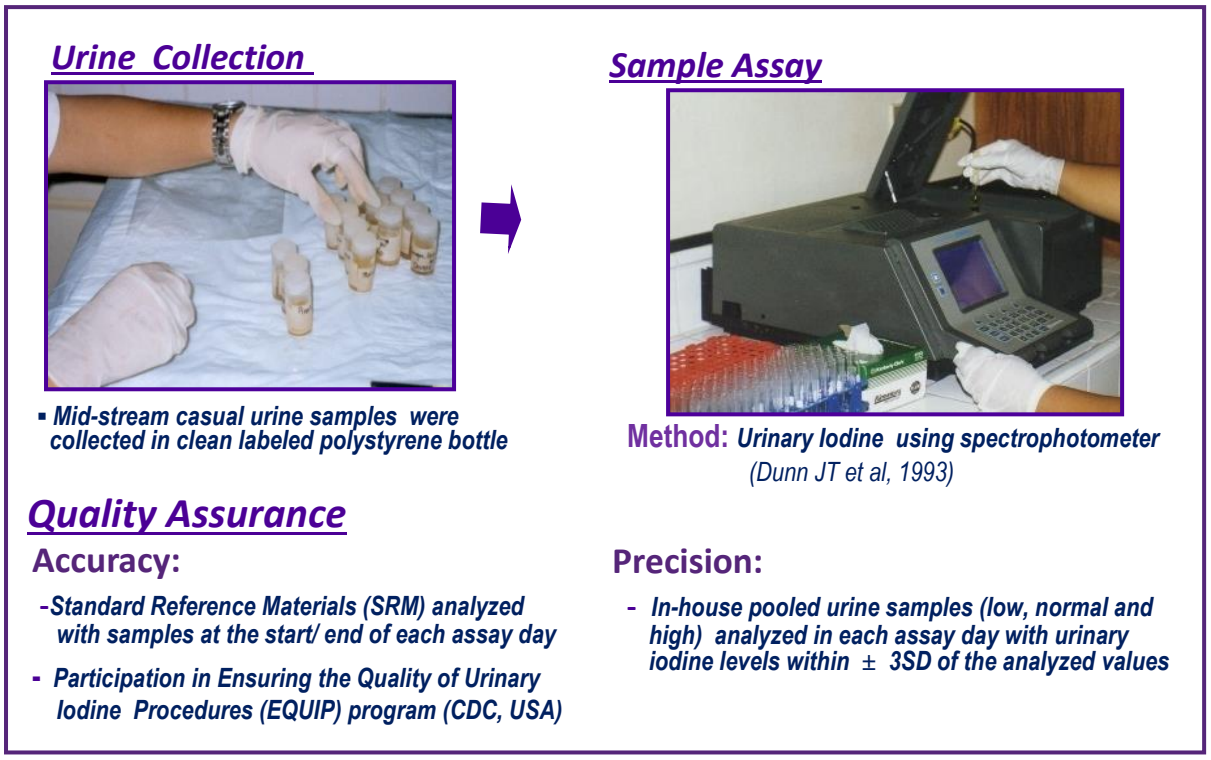


Figure 6. Urinary Iodine Excretion (UIE) determination by acid digestion method

2.4 Biochemical Survey Form

A four (4) page form(8th NNS Form 8.1 – Biochemical Information and 8th NNS-Biochemical Indices) was used to record results of the different biochemical measurements (Annex 8).

2.5 Ethical Review

The copy of the project proposal entitled "8th National Nutrition Survey, Philippines 2013" was submitted to the FNRI Institutional Ethics Review Committee (FNRI-IERC) for clearance on January 22, 2013. However, since FNRI is mandated to define the nutritional status of Filipinos, clearance of the said project was not necessary (See 8th NNS Overview Monograph).

Written consent to participate in the 8th National Nutrition Survey was obtained from adult respondents and participants prior to the interview and other measurements. An Assent form was signed by children aged 7 years and below. The Informed Consent and Assent forms were translated into dialects that are most commonly spoken in the Philippines; it explained the background and objectives of the survey, the data collection procedures, involved risks (any undesirable effect that may result or invasive circumstances, e.g., expected duration of the interview with respondent) and benefits of participation, confidentiality of information, option to withdraw without penalty or consequences.

Since the "Thalassemia" and "Vitamin D" studies were riders of the 8th NNS, a separate Ethics approval was sought (Annex 9 and 10). A separate written consent was also sought from the participants of these two (2) studies (Annex 11 and 12).

2.6 NSCB/PSA Review and Approval

Philippine Statistics Authority (PSA) also granted clearance for the 2013 National Nutrition Survey on June 19, 2013 (See 8th NNS Overview Monograph).

2.7 Data Processing, Analysis and Interpretation of Results

Data were organized and processed following prepared dummy tables using SPSS and STATA version 12. Different indices were used to evaluate the nutritional status of different age groups and physiologic status.

Interpretation of results for the different parameters are shown in the succeeding tables: Tables 8 and 9 for anemia, Table 10 for ferritin, Tables 11 and 12 for VAD, Table 13 for vitamin D, Tables 14 and 15 for zinc deficiency and Tables 16 and 17 for IDD. Interpretation of results for the thalassemia study is shown in Figure 7.

Table 8. Hemoglobin values below which anemia is likely to be present in populations at sea level

Age/Sex/ Physiologic State\	Normal hemoglobin Level (g/dL)
Children, 6 mos – 6 y	11.0
6.1 – 14 y	12.0
Males ≥15 y	13.0
Females ≥ 15 y (non pregnant/non lactating)	12.0
Pregnant women	11.0
Lactating women	12.0

WHO, 1972

Table 9. Classification of public health significance of anemia in populations on the basis of prevalence estimated from blood levels of hemoglobin

Category of public health significance	Prevalence of anemia (%)
Severe	≥ 40.0
Moderate	20.0 – 39.9
Mild	5.0 – 19.9
Low	≤4.9

WHO, 2001

Table 10. Relative extent of iron stores on the basis of serum ferritin

Iron stores	Serum ferritin (ug/L)			
	Less than 5 yrs of age		More than 5 yrs of age	
	Male	Female	Male	Female
Depleted iron stores	< 12	< 12	< 15	<15
Depleted iron stores in the presence of infection	< 30	< 30	-	-
Severe risk of iron overload	-	-	> 200 (Adult males)	> 150 (Adult females)

WHO, 2001

Table 11. Guidelines used for the interpretation of Vitamin A Biochemical Data

Level	Serum Retinol	
	µg/dL	µmol/L
Deficient	<10	<0.35
Low	10 – 19	0.35 – 0.69
Acceptable	20 - 49	0.70 – 1.74
High	≥ 50	≥ 1.75

WHO/UNICEF/HKI/IVACG, 1972

Table 12. Prevalence cut-offs to define vitamin A deficiency in a population and its level of public health significance

Public Health Importance Degree of Severity	Serum or Plasma Retinol Prevalence (%)
Mild	2 - < 10
Moderate	10- < 20
Severe	≥ 20

WHO, 1996

Table 13. Guidelines for interpretation of serum 25 hydroxyvitamin D

Level	Serum vitamin D nmol/mL
Deficient	< 50
Insufficient	50 - <75
Sufficient	≥ 75

Holick, 2009 ; Holick and Chen, 2008

Table 14. Suggested lower cut-offs for the assessment of serum zinc concentrations in population

Age / physiologic group	Zinc, µg/dL		
	AM Fasting	AM Other	PM
Children, <10 yrs	Not available	65	57
Females, > 10 yrs	70	66	59
Non-pregnant			
Pregnant			
1st trimester	56	56	56
2nd & 3rdtrimester	50	50	50
Males, > 10 yrs	74	70	61

Hotz and Brown, 2004

Table 15. Suggested guidelines for public health concern for zinc deficiency

Magnitude	% Prevalence
Low	< 5
Moderate	5- <10
Moderately high	10 - 20
High	≥ 20

Hotz and Brown, 2004

Table 16. Epidemiological criteria for assessment of iodine nutrition in a population based on median or range of urinary iodine concentrations in school-aged children (≥ 6 yrs)*

Urinary iodine Excretion (UIE), µg/L	Iodine Intake	Iodine Status
<20	Insufficient	Severe iodine deficiency
20 -49	Insufficient	Moderate iodine deficiency
50 - 99	Insufficient	Mild iodine deficiency
100 - 199	Adequate	Optimal
200 - 299	More than adequate	Risk of induced hyperthyroidism in susceptible groups
≥ 300	Excessive	Risks of adverse health Consequences

The indicator of iodine deficiency "elimination" is a median value of 100 µg/L that is, 50% of the sample should be above 100 µg/L, and not more than 20%of the samples should be below 50µg/L (ICCIDD, 1994)

**Applies to adults, but not to pregnant women (WHO, UNICEF AND ICCIDD, 2001)*

Table 17. Epidemiological criteria for assessing iodine nutrition based on urinary iodine concentrations of pregnant women

Median Value µg/L	Iodine Intake µg/d
<150	Insufficient
150 - 249	Adequate
250 - 499	Above requirements
≥ 500	Excessive*

**** The term "excessive" means in excess of the amount required to prevent and control iodine deficiency.***

(WHO, UNICEF, and ICCIDD, 2007)

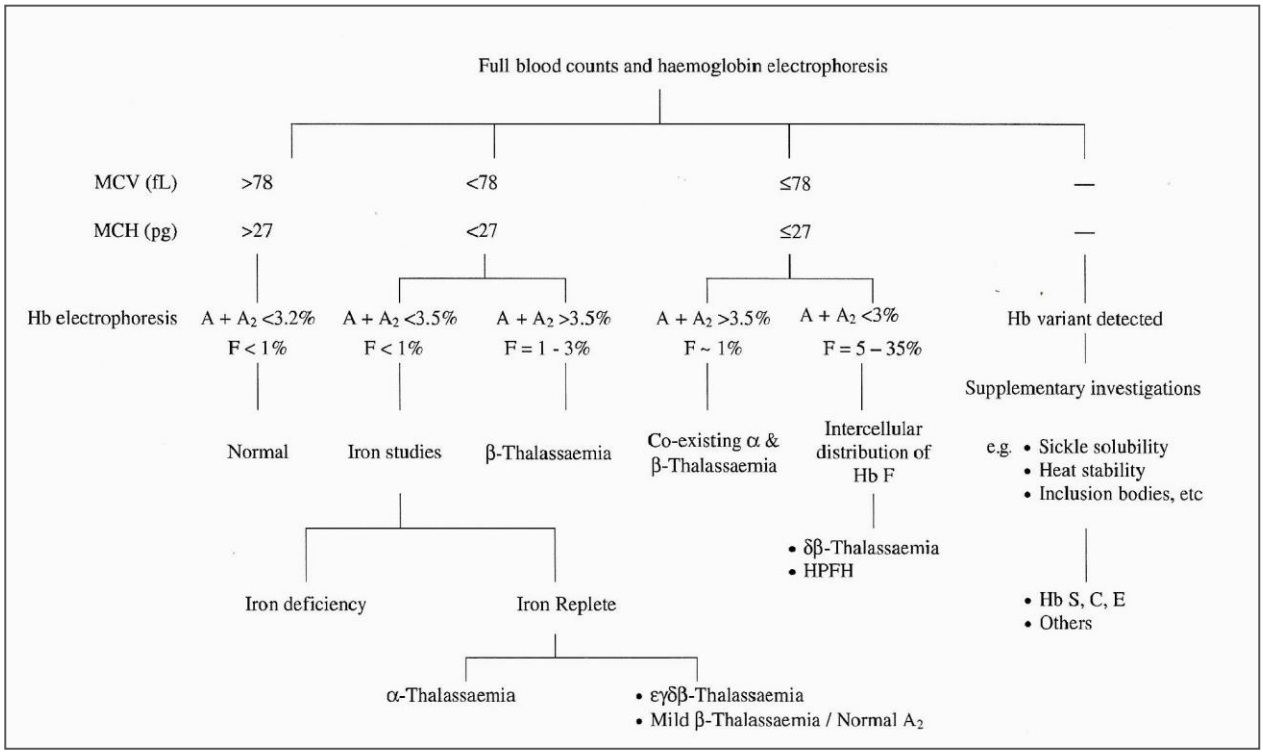


Figure 7. A guide to the diagnosis of the different forms of hemoglobinopathies in carriers adopted from Cao et al., 2001)

3. RESULTS

3.1 Anemia

Anemia prevalence by age, sex, and physiologic state is seen in Figure 8. Cut-offs for interpretation of results are in Tables 8 and 9. Over-all anemia prevalence was considered a "mild" public health problem at 11.2%. It was highest among the infants 6 months to < one (1) year, at 40.5%, and remains to be a severe public health problem. Among the elderly and pregnant women, anemia prevalence was a moderate public health problem.

Figure 9 shows anemia prevalence by single age group among the preschool children. Overall, anemia prevalence among the preschool children 6 months to 5 years old was 13.8%. It was highest among the infants 6 months < 1 year at 40.5% indicating a "severe" public health problem,and lowest among the children 5 years old at 4.3%.Anemia prevalence decreased with age.

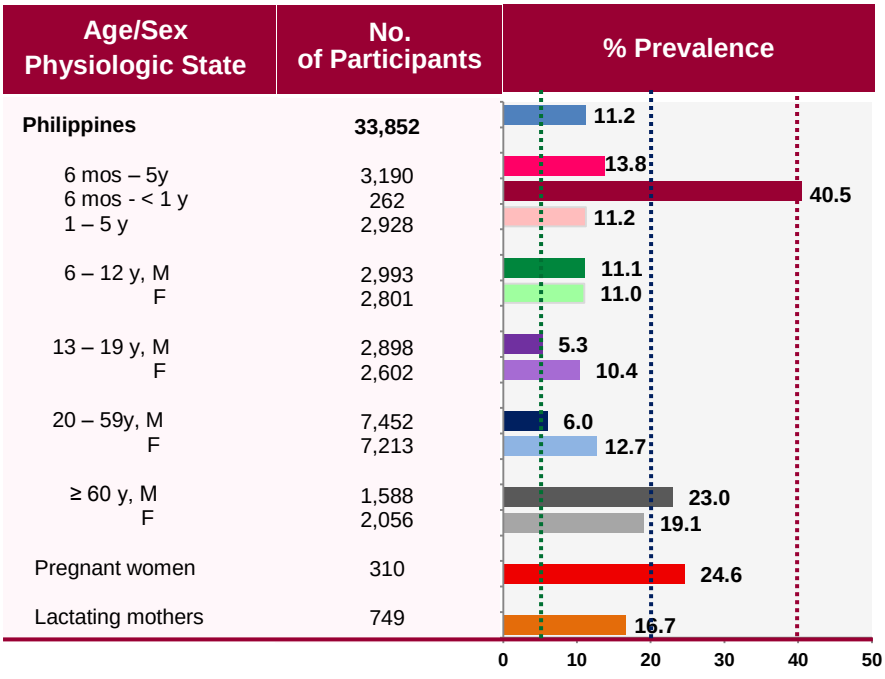


Figure 8. Anemia prevalence by age, sex and physiologic state: Philippines, 2013

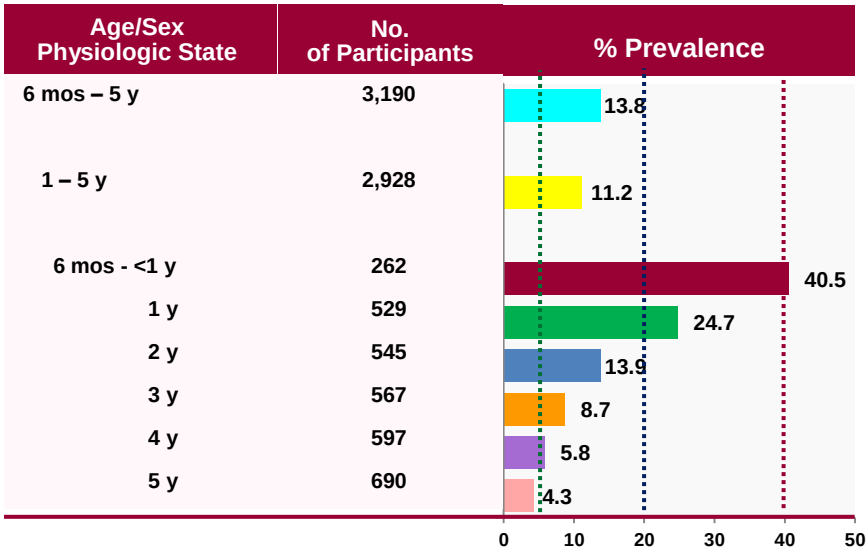
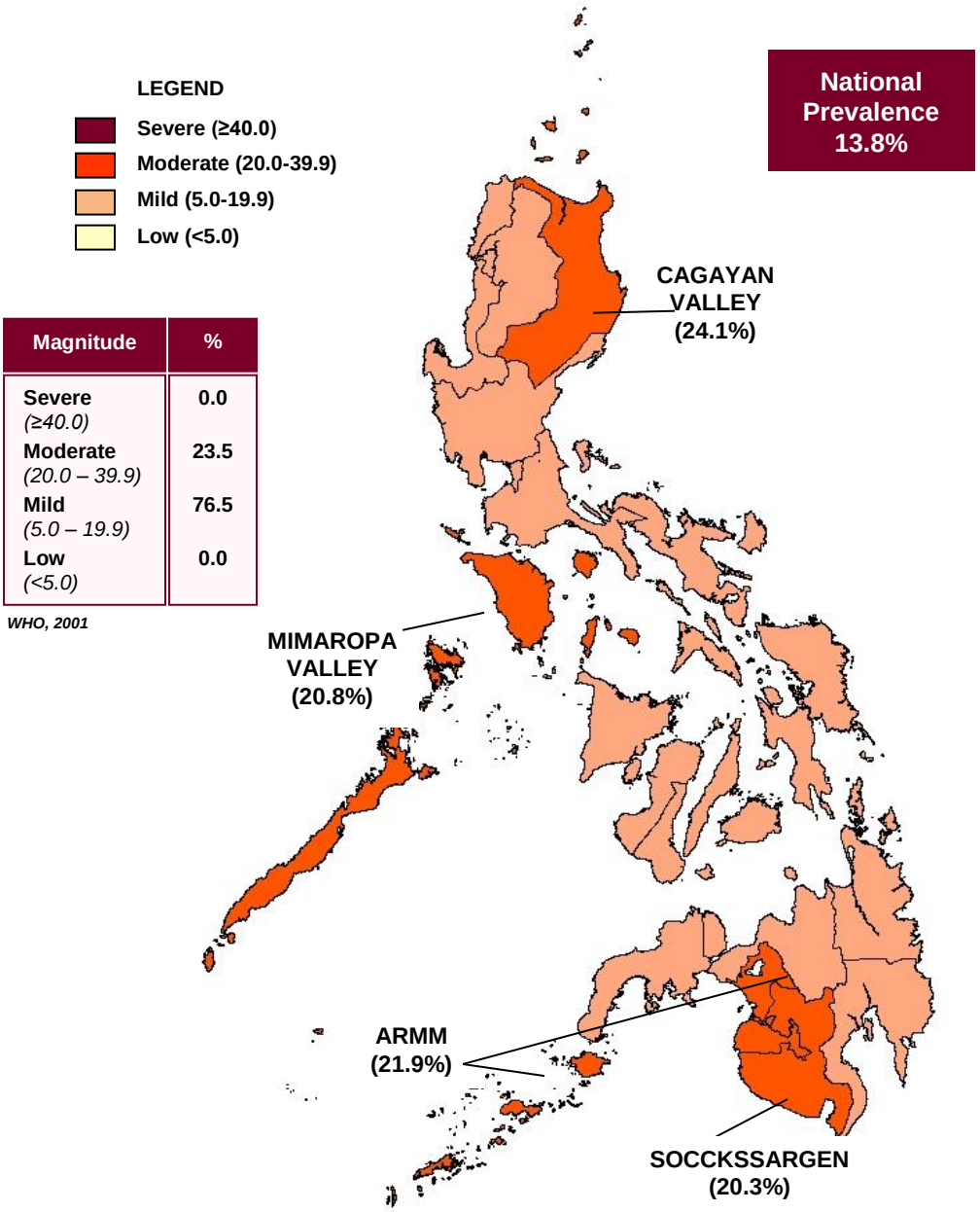


Figure 9. Anemia prevalence among infants and preschool children by single age group: Philippines, 2013

3.1.1 Prevalence of Anemia by Region:

The anemia prevalence, standard error (SE), 95% confidence interval (95% CI), margin of error (ME), and coefficient of variation (CV) by region among specific age and physiologic groups are in Appendix 1-5. Regional prevalence for the pregnant and lactating women were not computed due to the very few samples collected. Regions with CV greater than 10% indicate prevalence rates may not be considered precise (Cochran, 1977).

Preschool children: Over all prevalence of anemia among the preschool children was 13.8% (95% CI 12.2-15.5) (Appendix 1 and Figure 10) which is classified as anemia of "mild" public health significance. Highest prevalence was found in Cagayan Valley with 24.1% (95% CI 18.83-30.32) and lowest was in Zamboanga Peninsula with 5.0% (95% CI 2.51-9.77). Four (4) of the 17 regions or 23.5% had anemia prevalence classified as "moderate" public health significance (Cagayan Valley, SOCCKSARGEN, ARMM, and MIMAROPA). Thirteen (13) of the 17 regions or 76.5% had anemia classified as "mild" public health significance.



Magnitude	%
Severe *(≥40.0)*	0.0
Moderate *(20.0 – 39.9)*	23.5
Mild *(5.0 – 19.9)*	76.5
Low *(<5.0)*	0.0

WHO, 2001

Figure 10. Magnitude of anemia prevalence among preschool children, 6 months to 5 years old by region: Philippines, 2013

School-age children: The overall anemia prevalence among the school-aged children 6-12 years old (Appendix 2 and Figure 11) was 11.1% (95% CI 10.0-12.3), which is classified as anemia of "mild" public health significance. The highest anemia prevalence was noted in MIMAROPA at 21.6% (95% CI 14.8 – 30.4) while Zamboanga Peninsula had the lowest at 4.2% (95% CI 2.1 – 8.2). One (1) out of the 17 regions (MIMAROPA) or 5.9% had "moderate" anemia prevalence, while 15 or 88.2% had "mild" anemia prevalence.

Adolescents: The overall anemia prevalence among the adolescents 13-19 years old was 7.7% (95% CI 6.9 – 8.7), which is classified as anemia of "mild"public health significance (Appendix 3 and Figure 12). The highest anemia prevalence was noted in Cagayan Valley at 15.7% (95% CI 12.6 – 19.4) while CAR had the lowest at 3.8% (95% C1 2.3 – 6.4). Thirteen (13) of the 17 regions or 76.5% had "mild" anemia prevalence, while 4 regions or 23.5% had "low" anemia prevalence.

Adults: The overall anemia prevalence among the adults 20-59 years old was 9.3% (95% CI 8.7– 10.00), which is classified as anemia of "mild" public health significance (Appendix 4 and Figure 13). The highest anemia prevalence was noted in Cagayan Valley at 13.4% (95% CI 10.0 – 16.6) while CAR had the lowest at 5.2% (95% CI 3.2– 8.4). All of the regions had anemia of "mild" public health significance.

Elderly: The over-all anemia prevalence among the elderly, 60 years and over, was 20.8% (19.3 – 22.4), which is anemia of "moderate" public health significance (Appendix 5 and Figure 14). Highest prevalence was seen in Cagayan Valley at 38.5% (95% CI 32.15 – 45.19), which is classified as anemia of "moderate" public health significance. Lowest prevalence was seen in Davao at 10.3% (95% CI 5.89 – 17.35) which is anemia of "mild" public health significance. Nine (9) of the regions or 52.9% had anemia of "moderate" public health significance. Eight (8) or 47.1% had anemia of "mild" public health significance.

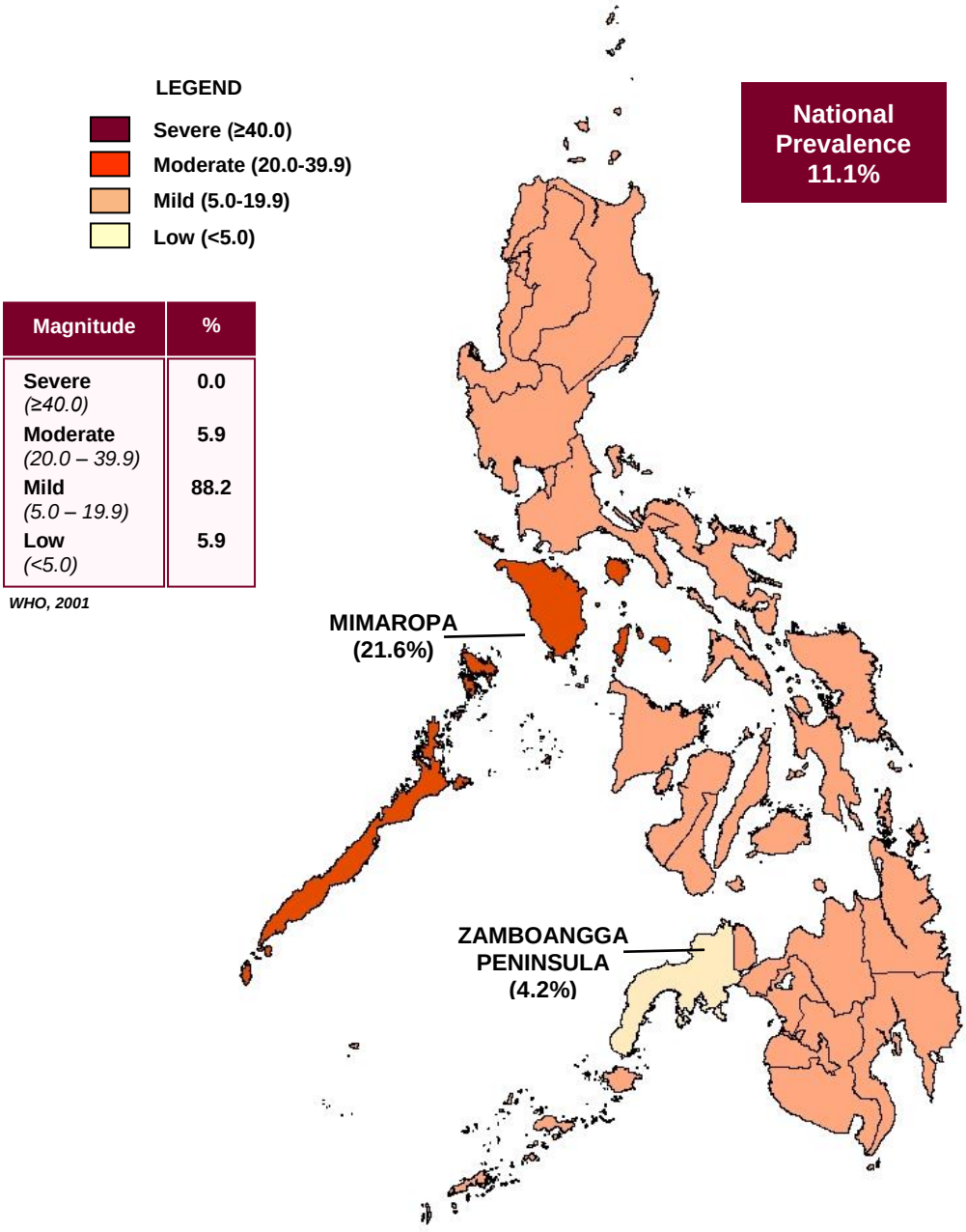
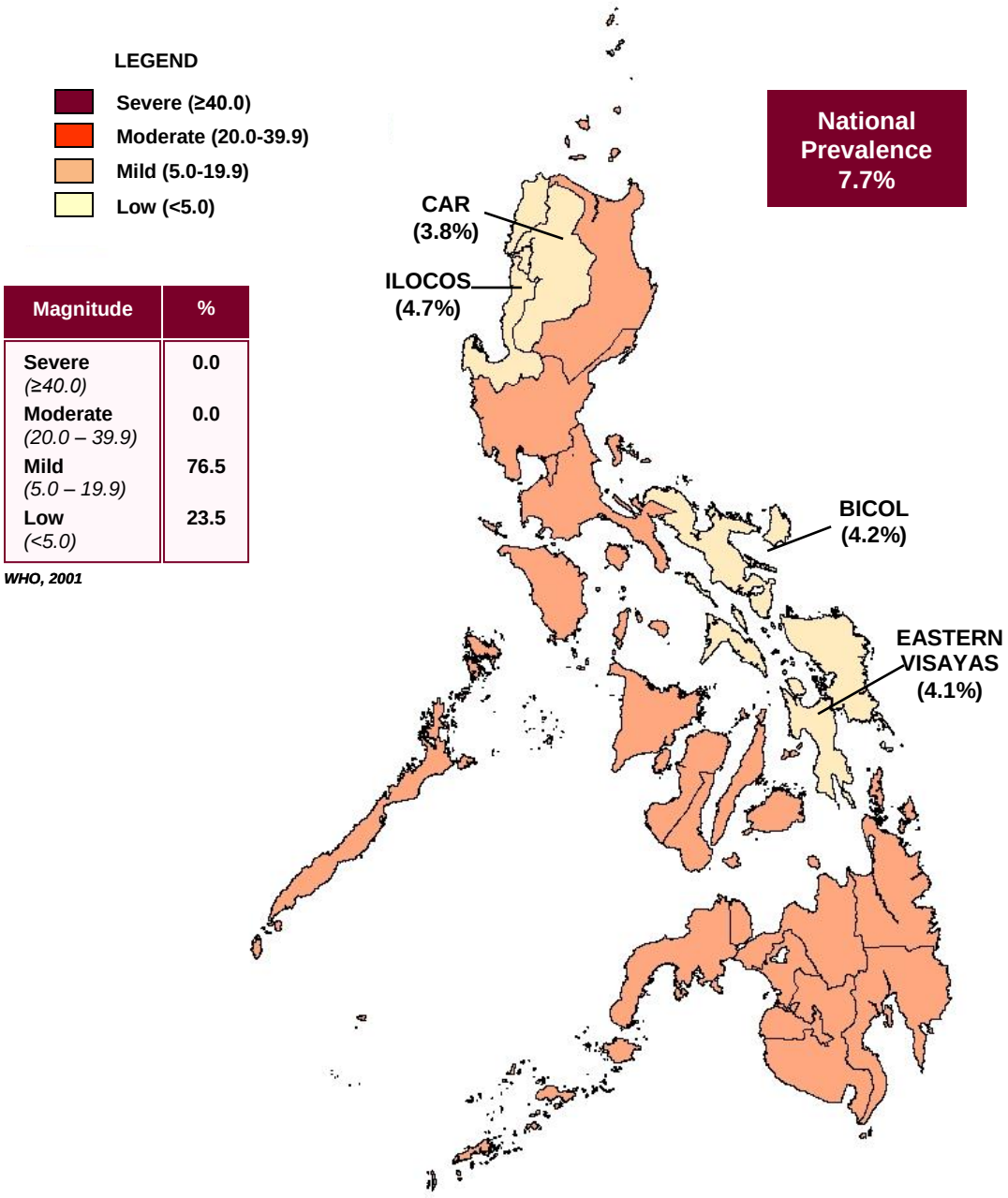


Figure 11. Magnitude of anemia prevalence among school-aged children, 6-12 years old by region: Philippines, 2013



Magnitude	%
Severe *(≥40.0)*	0.0
Moderate *(20.0 – 39.9)*	0.0
Mild *(5.0 – 19.9)*	76.5
Low *(<5.0)*	23.5

WHO, 2001

Figure 12. Magnitude of anemia prevalence among adolescents, 13-19 years old by region: Philippines, 2013

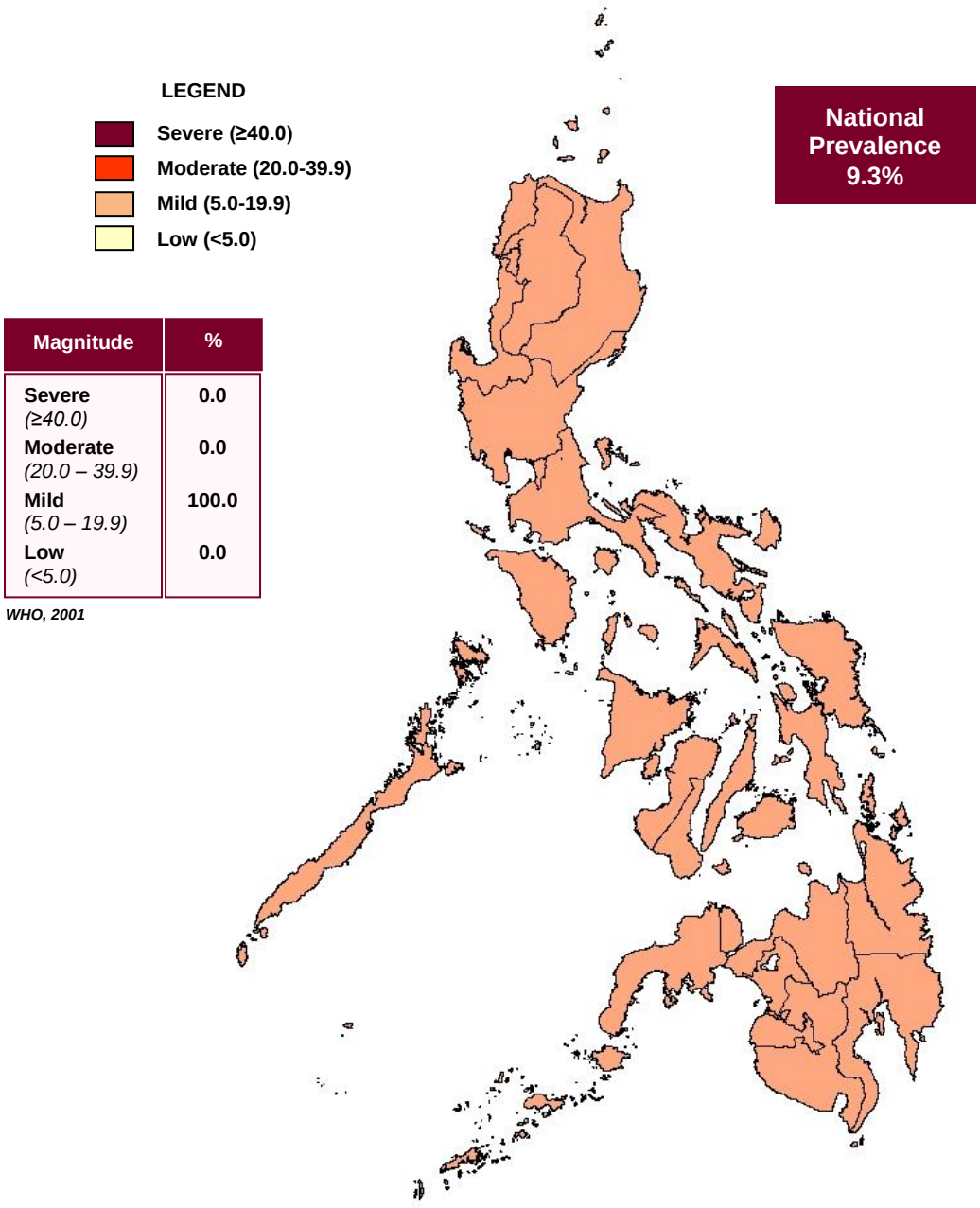
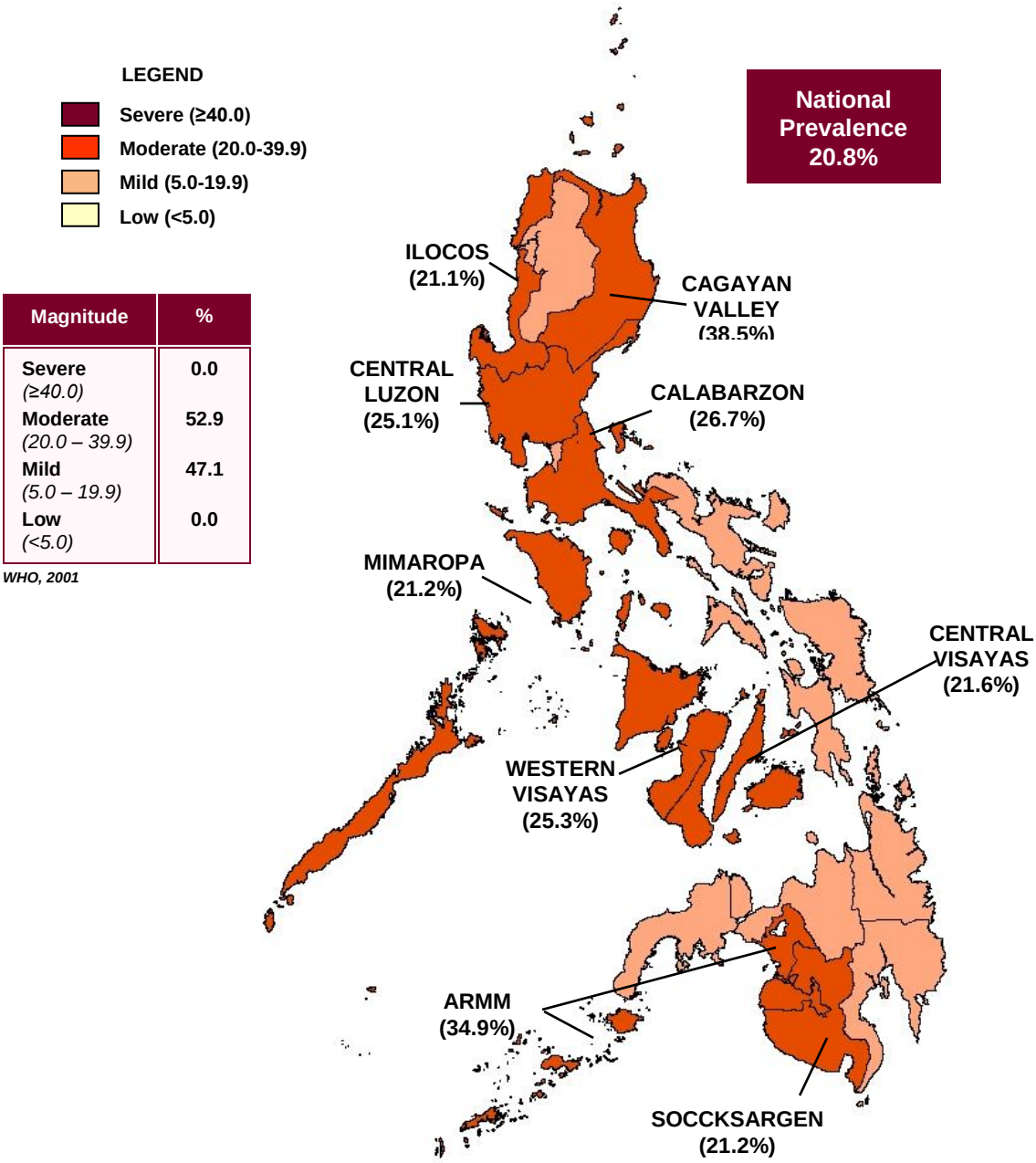


Figure 13. Magnitude of anemia prevalence among adults, 20–59 years old by region: Philippines 2013



Magnitude	%
Severe *(≥40.0)*	0.0
Moderate *(20.0 – 39.9)*	52.9
Mild *(5.0 – 19.9)*	47.1
Low *(<5.0)*	0.0

WHO, 2001

Figure 14. Magnitude of anemia prevalence among the elderly, ≥ 60 years by region: Philippines 2013

3.1.2 Prevalence of anemia by Place of Residence:

Over-all, anemia prevalence in the rural areas was higher (11.7%) compared to the prevalence in the urban areas (10.7%) (Figure 15). Among the children, anemia in the urban areas was similar to those in the rural areas. Trend was similar among the adults (Figure 16). However, among the elderly (Figure 16) and the lactating mothers (Table 17), anemia prevalence was higher in the rural areas. On the other hand, anemia prevalence among pregnant women was higher in the urban areas (Figure 17).

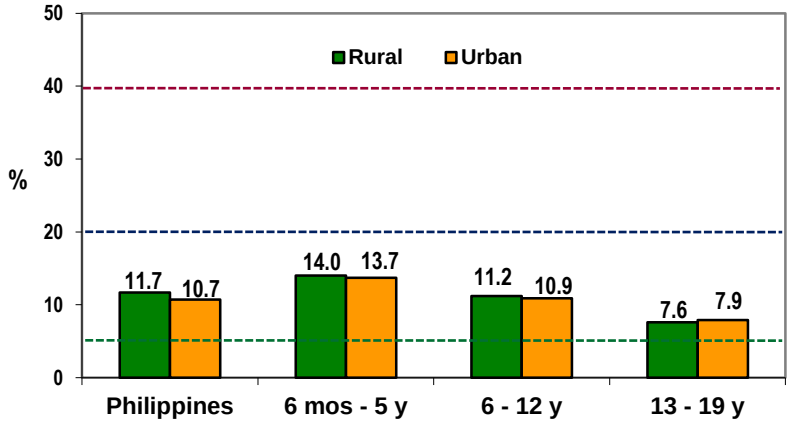


Figure 15. Prevalence of anemia among children by place of residence: Philippines, 2013

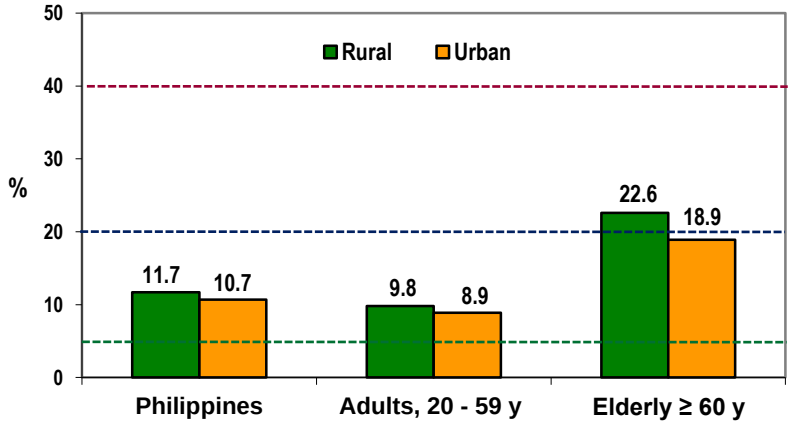


Figure 16. Prevalence of anemia among adults and elderly by place of residence: Philippines, 2013

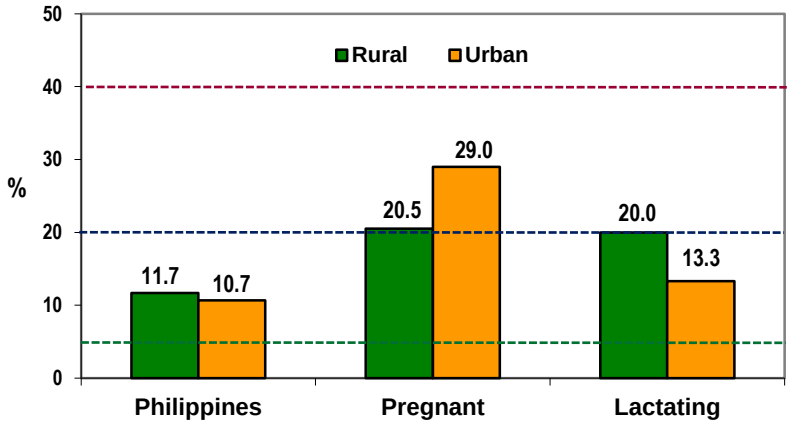


Figure 17. Prevalence of anemia among pregnant women and lactating mothers by place of residence: Philippines, 2013

3.1.3 Prevalence of Anemia by Wealth Quintile:

Among the infants, 6 months to 5 years, anemia prevalence was highest among the poorest at 16.5% and lowest among the richest at 7.9% (Figure 18). No trend was recorded from the poor to the richest among the 6-12 and 13-19 years old children. However, anemia prevalence was lowest among the richest for these age groups. It was 8.0% and 5.1% for the 6-12 years and 13-19 years, respectively.

Among the adults and the elderly, a trend was shown to be highest among the poorest and lowest among the richest (Figure 19). A trend was observed among the lactating mothers (Figure 20) but not among the pregnant women, where the rich pregnant women had the highest prevalence at 32.7% and lowest among the middle quintile group at 20.2%.

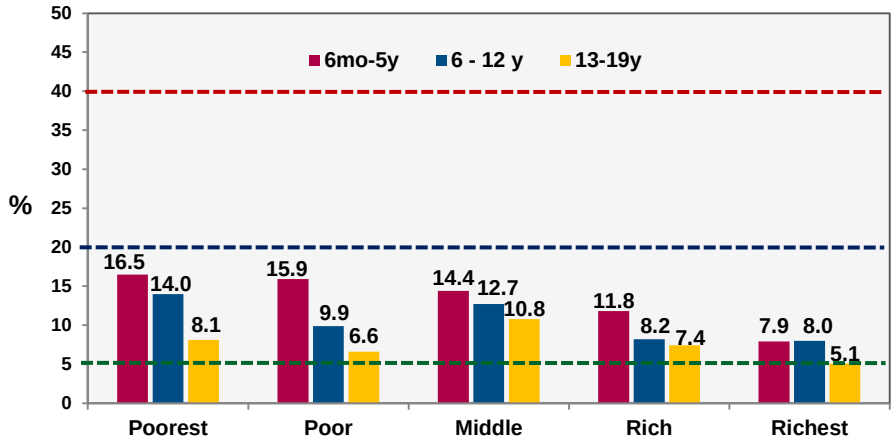


Figure 18. Prevalence of anemia among children by wealth quintile: Philippines, 2013

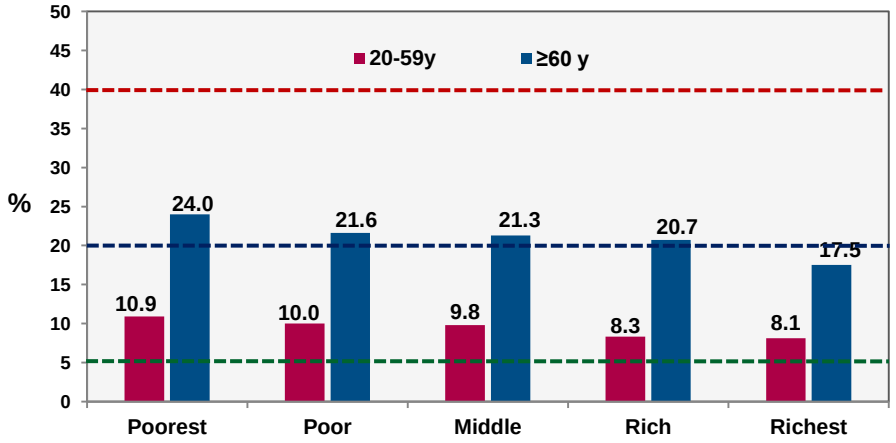


Figure 19. Prevalence of anemia among adults and elderly by wealth quintile: Philippines, 2013

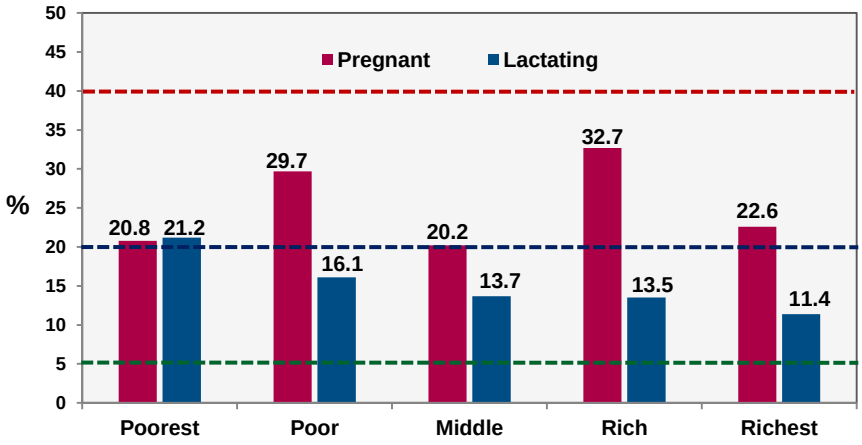


Figure 20. Prevalence of anemia among pregnant women and lactating mothers by wealth quintile: Philippines, 2013

3.1.4 Trends in Anemia Prevalence: 1993, 1998, 2003, 2008 and 2013

Philippines: Anemia prevalence in the Philippines declined from a level considered "moderate" in 1993 and 1998 to mild in 2008 and 2013 (Figure 21). Prevalence in anemia was not determined in all age groups in 2003.

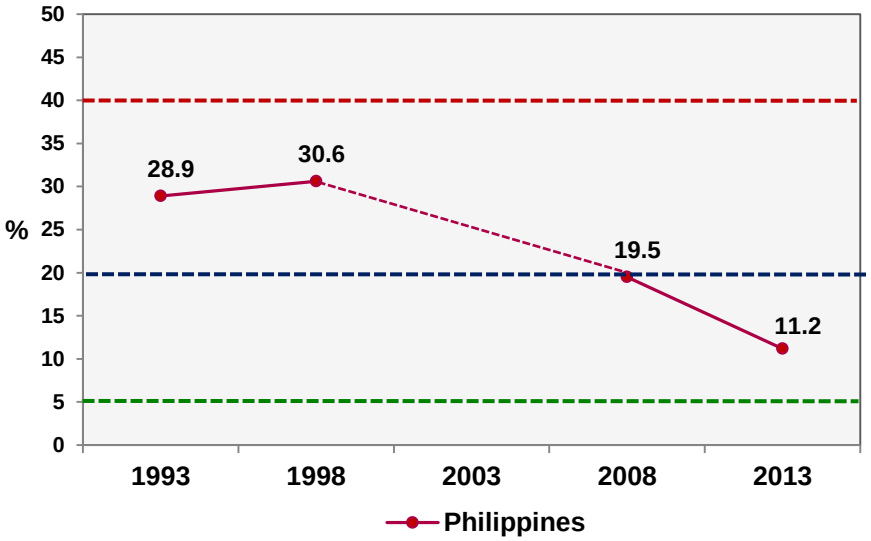


Figure 21. Trend in anemia prevalence, Philippines: 1993, 1998, 2008 and 2013

Children: Figure 22 shows the trend in anemia prevalence in the 1993, 1998, 2003, 2008 and 2013 NNS series for the children. Anemia prevalence among the children 6 months-5 years was "moderate" in the 1998 to 2008 survey, but declined to 13.8% in 2013, a level classified as "mild". Segregating the infants 6 months to <1year, from the children 1-5 years, shows that anemia among the infants was a "severe" (>40%) public health problem in all the surveys. It was highest at 66.2% recorded in 2003. Among the preschool children 1-5 years old, anemia prevalence was classified as "severe" in 1993, declined to "moderate" from 1998 to 2008, further declining to "mild" in 2013.

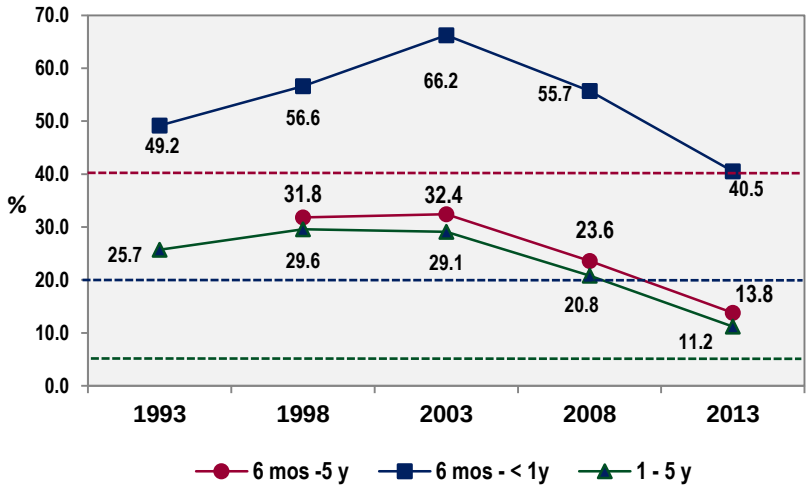


Figure 22. Trends in anemia prevalence among children: Philippines 1993, 1998, 2003, 2008 and 2013

Pregnant and Lactating Women: Among the pregnant women, anemia prevalence was classified as "severe" from 1993 to 2008 (Figure 23). It was highest at50.7% in 1998. In 2013, anemia prevalence declined to 24.6% and was classified as "moderate". Among the lactating mothers, anemia prevalence was "severe" from 1993 to 2003 but declined to "moderate" in 2008. The 2013 anemia prevalence among lactating mothers at 16.7% was classified as "mild".

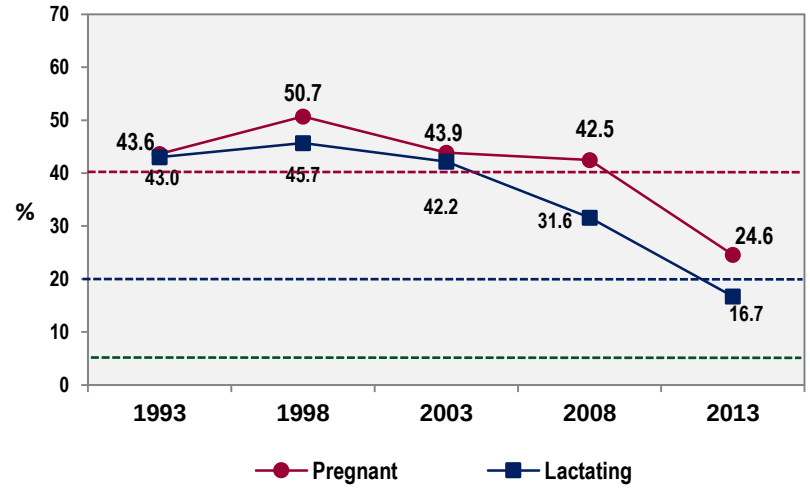


Figure 23. Trends in anemia prevalence among pregnant women and lactating mothers: Philippines 1993,1998, 2003, 2008 and 2013

3.2 Thalassemia

Thalassemia was determined only in the NCR. Guideline for the interpretation of results is shown in Figure 7. Table 18 shows electrophoresis results of 122 anemic 6-59 year old individuals and 8 pregnant women with low MCV and/or MCH values. Of the 122 anemic individuals, 54 had MCV ≤ 78 fl and MCH ≤ 27 pg and were all from the 6-59 year-old age group. None of the anemic pregnant women had low MVC and MCH values.

Over-all, there was a total of 21 of the 122 anemic individuals or 17.2% with some form of hemoglobinopathy. Of the 54 individuals with low MCV and MCH, 51 had low HbA2 (<3.5%); 13.9% or 17 of the 122 anemics had α Thalassemia and 0.8% or one (1) of the 122 anemics had IDA concomitant with E hemoglobinopathy. Among the anemics, 27.0% or 33 of the 122 had IDA.

Beta Thalassemia was found in 1.6% or 2 of the 122 anemics with low MCV, low MCH but with high HbA2 (≥ 3.5%). One (1) or 0.8% of the 122 anemics had ß thalassemia E Hemoglobinopathy interacting.

Table 18. Distribution of thalassemia and abnormal hemoglobin among anemic individualsin the National Capital Region, 2013

Hematological findings and hemoglobin pattern analysis	6 – 59 yrs			Pregnant Women		
	n	%	Interpretation	n	%	Interpretation
Anemic*	122			8		
Low MCV (≤ 78 fl)	54			0	0	
Low MCH (≤ 27 pg)	54			0	0	
Low HbA2 (< 3.5%)	(51)			0	0	
Ferritin (≥ 15 ng/mL)	17	13.9	α Thalassemia			
Ferritin (< 15 ng/mL)	33	27.0	Iron Deficiency Anemia (IDA)			
Ferritin (< 15 ng/mL) with HbE	1	0.8	IDA, concomitant with E hemoglobinopathy			
High HbA2 (≥ 3.5%)	(3)					
Ferritin (≥ 15 ng/mL)	2	1.6	β Thalassemia			
Ferritin ((≥ 15 ng/mL) presence of HbE	1	0.8	β Thalassemia E Hemoglobinopathy Interacting			
Ferritin (<15 ng/mL)	0					
Total with hemoglobinopathy	21	17.2				

*Based on WHO criteria

3.3 Iron Deficiency Anemia

Iron deficiency anemia was determined only in the NCR. Serum ferritin (SF) was determined as a measure of iron stores. Cut-off for interpretation of results is shown in Table 10. The concentration of ferritin is positively correlated with the size of the total iron stores in the absence of inflammation (WHO, 2011). Serum ferritin was determined from a total of 875 blood samples from 127 children 6-12 years, 279 adolescents 13-19 years, 452 adults 20-59 years and 17 pregnant women in the NCR (Table 19).

Among the school children aged 6-12 years, mean SF was 35.00ng/mL and 9.0% had SF levels <15 ng/mL. SF was higher among the anemic children compared to the non-anemic children (47.61 vs 34.44 ng/mL). Among the anemic children there were no children with <15 ng/mL SF. On the other hand, among the non-anemic, 9.4% had iron deficiency.

Serum ferritin among the adolescents was 41.35ng/mL and 9.6% had SF values <15 ng/mL. SF levels were higher among the non-anemic adolescents compared to the anemic adolescents (46.85 vs 8.33ng/mL). Iron deficiency was present in 5.7% of the non-anemic adolescents. Iron deficiency anemia was present in 54.7 %.

Serum ferritin among the adults was 56.81 ng/mL and 17.9% had SF values <15ng/mL. SF values among the non-anemic adults were higher compared to the anemic adults (71.44 vs 12.04 ng/mL). More than half (54.4%) of the anemic adults had iron deficiency anemia. On the other hand, only 12.5% of the non-anemic adults had iron deficiency.

Serum ferritin among the pregnant women was 24.62 ng/mL and 29.0% had values <15% ng/mL. The non-anemic pregnant women had higher SF values compared to the anemic pregnant women (51.46 vs 8.48 ng/mL). A very high proportion (70.9%) of pregnant women had iron deficiency anemia.

Presence of infection or inflammation was not determined among the individuals in the ferritin survey. However, higher ferritin values among the anemic 6-12 year group, compared to the non-anemic group, indicate the presence of infection, since infection tends to increase ferritin levels.

Table 19. Mean serum ferritin level and prevalence of iron deficiency anemia in the National Capital Region, 2013

Population group	Number	Serum Ferritin (ng/mL)	
		X ± SD	% < 15
Children (6-12 yrs)			
All	127	35.00 ± 2.09	9.0 ± 1.4
Non-Anemic	121	34.44 ± 2.12	9.4 ± 1.3
Anemic	6	47.61 ± 4.41	0
Children (13-19 yrs)			
All	279	41.35 ± 2.77	9.6 ± 0.9
Non-anemic	260	46.85 ± 2.28	5.7 ± 1.9
Anemic	19	8.33 ± 5.73	54.7 ± 15.6
Adults (20-59 yrs)			
All	452	56.81 ± 4.10	17.9 ± 2.0
Non-anemic	388	71.44 ± 3.23	12.5 ± 5.8
Anemic	64	12.04 ± 6.48	54.4 ± 5.8
Pregnant women			
All	17	24.62 ± 3.51	29.0 ± 13.5
Non-anemic	10	51.46 ± 2.10	0
Anemic	7	8.48 ± 2.95	70.9 ± 14.9

3.4 Vitamin A Deficiency

Serum retinol was determined as the parameter for vitamin A status. Cut-off for interpretation of results is shown in Tables 11 and 12. The over-all prevalence of VAD (deficient and low levels) is 6.2%, indicating the presence of a "mild" public health problem in the Philippines (Figure 24). Prevalence among the preschool children aged 6 months-5 years was 20.4 % which is considered a "severe" public health problem. Disaggregating this into infants and young children, highest prevalence was recorded among the 6months to < 1 year old infants at 27.9%, followed by the young children aged 1-5 years at 19.6%. The prevalence of VAD among the infants was classified as "severe" public health problem, while among the young children, it was "moderate".

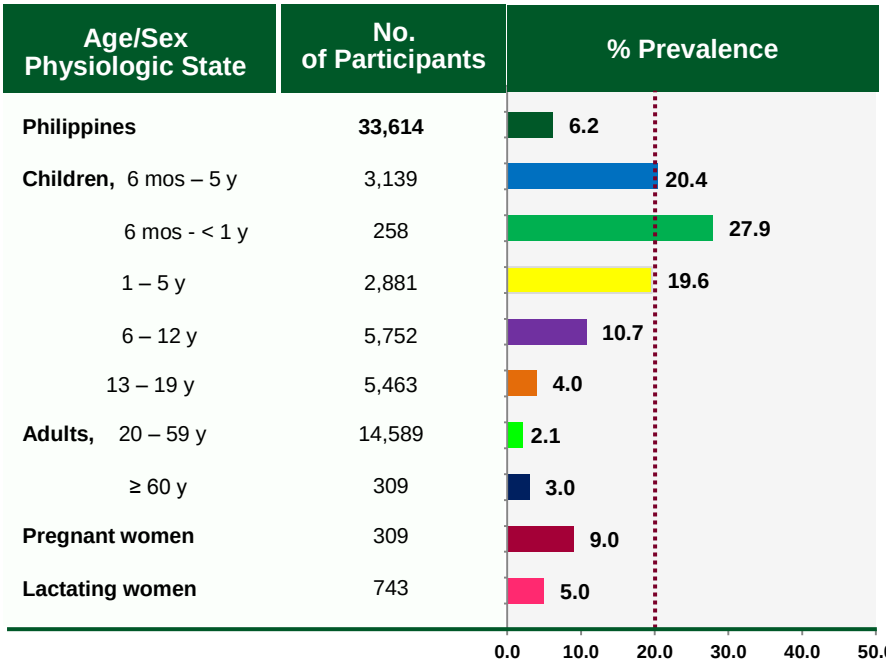


Figure 24. Prevalence of vitamin A deficiency by age and physiologic group: Philippines 2013

VAD among the 6-12 years, 13-19 years, 20-59 years and the elderly, all indicate "mild" public health problem (Table 20). Among the pregnant women and lactating mothers, the prevalence of VAD was 9.0% and 5.0%, respectively, both indicating "mild" VAD for these physiologic groups.

Table 20. Serum retinol level and percent distribution by age and physiologic state: Philippines, 2013

Age/ Physiologic State	n	Serum retinol, µg/dL Mean ± SD	% Distribution		
			Def & Low	Acceptable	High
Philippines	33,614	39.3 ± 0.2	6.2	71.7	22.1
Children					
6 mos - 5 y	3,139	20.4 ± 0.3	20.4	78.4	1.3
6 - 12 y	5,752	29.7 ± 0.2	10.7	86.7	2.6
13 - 19 y	5,463	36.4 ± 0.3	4.0	85.1	10.9
Adults					
20 - 59 y	14589	46.0 ± 0.3	2.1	61.9	36.0
≥60 y	3,619	47.3 ± 0.4	3.0	57.0	40.0
Pregnant	309	33.7 ± 0.8	9.0	82.5	8.5
Lactating	743	37.2 ± 0.5	5.0	79.7	15.3

3.4.1. Prevalence of Vitamin A Deficiency (VAD) by Island Group

The over-all prevalence of VAD is 6.2%, indicating "mild" VAD public health problem. Prevalence of the three island groups, Luzon, Visayas and Mindanao also indicate "mild" VAD (Table 21).

Table 21. Prevalence of Vitamin A Deficiency (VAD) by Island Groups: Philippines, 2013

National / Island Group	Number	Serum Retinol, µg/L Mean ± SE	Percent distribution		
			Def & Low	Acceptable	High
Philippines	33,614	39.3 ± 0.2	6.2	71.7	22.1
Luzon	17,381	39.7 ± 0.3	5.4	71.8	22.8
Visayas	6,439	38.2 ± 0.7	7.5	72.7	19.8
Mindanao	9,794	39.3 ± 0.4	7.1	70.8	22.2

3.4.2. Prevalence of Vitamin A Deficiency (VAD) by Region

Over-all prevalence of VAD (Deficient and Low levels) among the preschool children aged 6 months–5 years is 20.4% indicating "severe" VAD (Figure 25). Interpretation of result is shown in Table 12. Highest VAD was seen in the Zamboanga Peninsula at 37.2% and lowest was in Central Luzon at 10.4%. Ten (10) or 58.5% of the regions (Ilocos, NCR, Bicol, Eastern Visayas, Central Visayas, Northern Mindanao, Zamboanga Peninsula, Davao, SOCCSKSARGEN and ARMM) had "severe" VAD problem. Moderate VAD was seen in 41.2 % of the regions.

Over-all prevalence of VAD among the school children was 10.7% indicating "moderate" VAD (Figure 26). Highest VAD was seen in Bicol at 19.1% and lowest was in Central Luzon at 3.2%. "Severe" VAD was seen in one (1) or 11.8% of the regions (Zamboanga Peninsula). "Moderate" VAD was seen in seven (7) or 41.2% of the regions (NCR, Ilocos, Bicol, Eastern Visayas, Western Visayas, ARMM and CARAGA). "Mild" VAD as seen in nine (9) or 52.9% of the regions (CAR, Cagayan Valley, Central Luzon, CALABARZON, MIMAROPA, Central Visayas, Northern Mindanao, Davao and SOCCKSARGEN). The rest of the regions had no VAD problem.

Over-all prevalence of VAD among the adolescents was 4.0% indicating "mild" VAD (Figure 27). Highest VAD was seen in Western at 7.9% and there was no VAD in CAR. None of the regions had "severe" and "moderate" VAD. "Mild" VAD was seen in 12 or 70.6% of the regions (NCR, Ilocos, Cagayan Valley, MIMAROPA, Bicol, Western Visayas, Central Visayas,

Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, ARMM, and CARAGA). The rest of the regions had no VAD problem.

Over-all prevalence of VAD among the adults was 2.1% indicating "mild" VAD (Figure 28.). Highest VAD was seen in the Zamboanga Peninsula at 4.7% and lowest was in Central Luzon at 0.5%. None of the regions had "severe" and "moderate" VAD. "Mild" VAD was seen in 9 or 62.9% of the regions (NCR, Ilocos, Bicol, Western Visayas, Central Visayas, Eastern Visayas, Zamboanga Peninsula, SOCCKSARGEN and ARMM). The rest of the regions had no VAD problem.

Over-all prevalence of VAD among the elderly was 3.0% indicating "mild" VAD (Figure 29). Highest VAD was seen in Western Visayas at 8.1% and no VAD was seen in ARMM. None of the regions had "severe" and "moderate" VAD. "Mild" VAD was seen in 10 or 58.8% of the regions (Ilocos, MIMAROPA, Bicol, Western Visayas, Central Visayas, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, SOCCKSARGEN and CARAGA). The rest of the regions had no VAD problem.

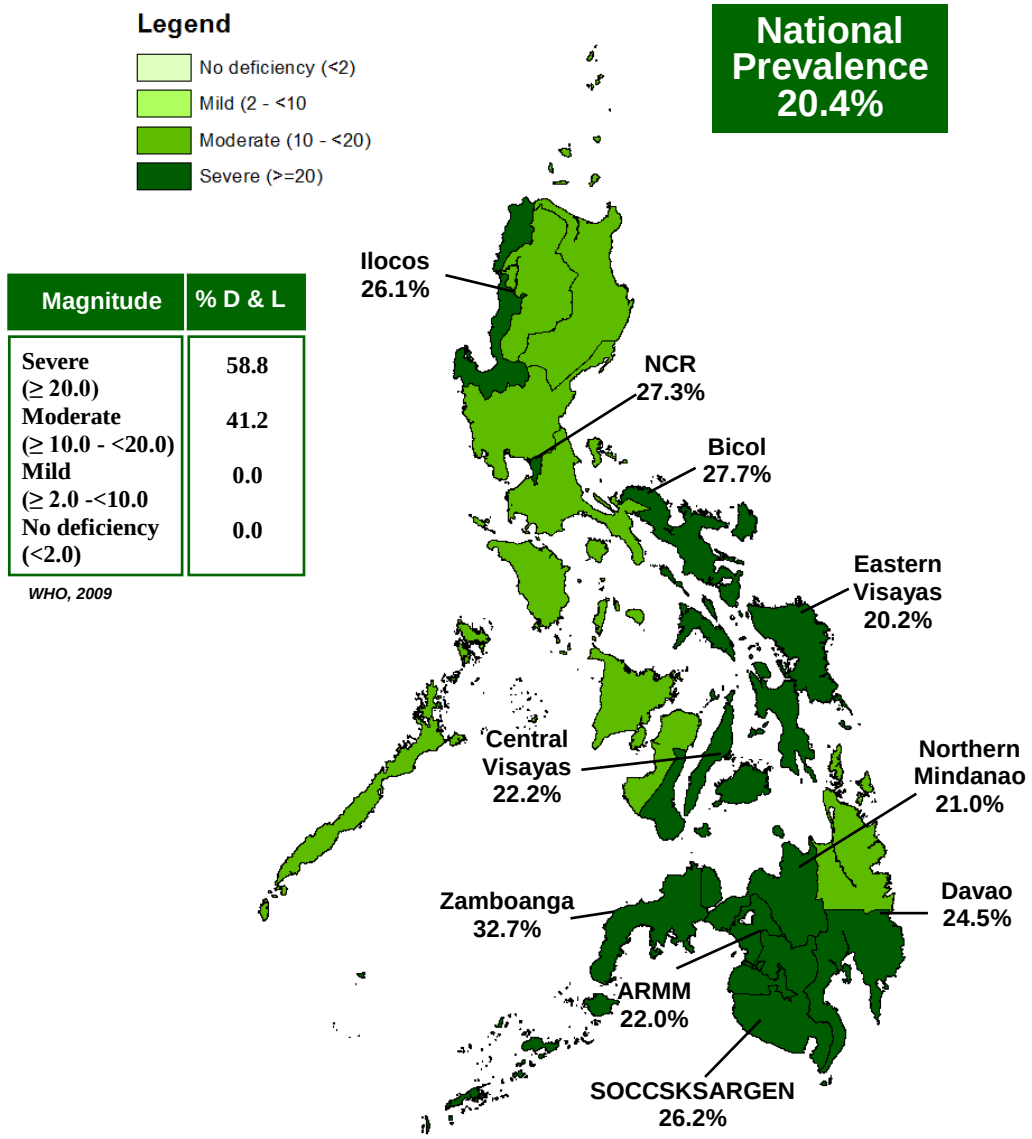


Figure 25. Magnitude of Vitamin A Deficiency (VAD) prevalence among preschool children, 6 months – 5 years by region: Philippines 2013

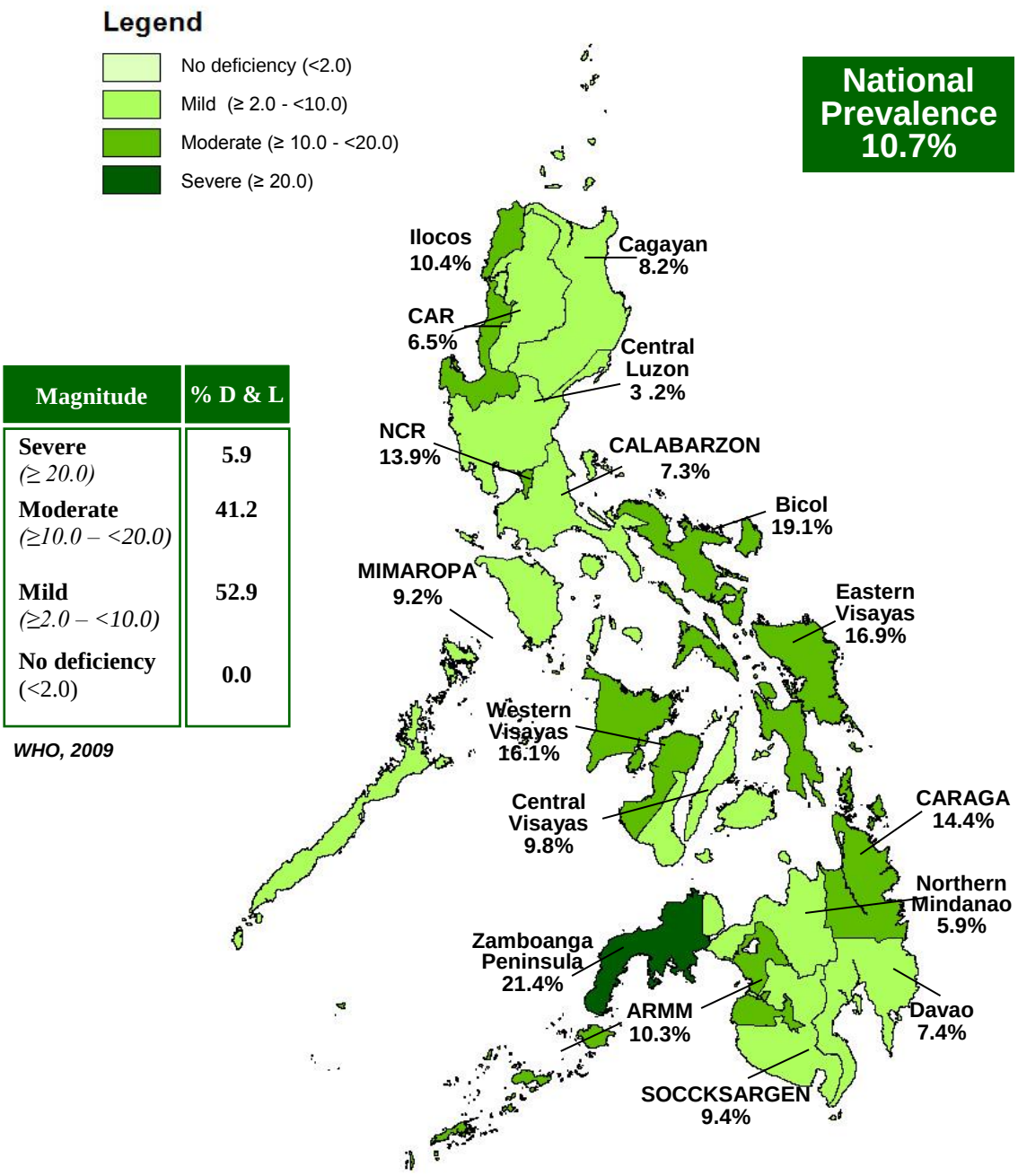


Figure 26. Magnitude of Vitamin A Deficiency (VAD) prevalence among schoolchildren, 6-12 years by region: Philippines 2013

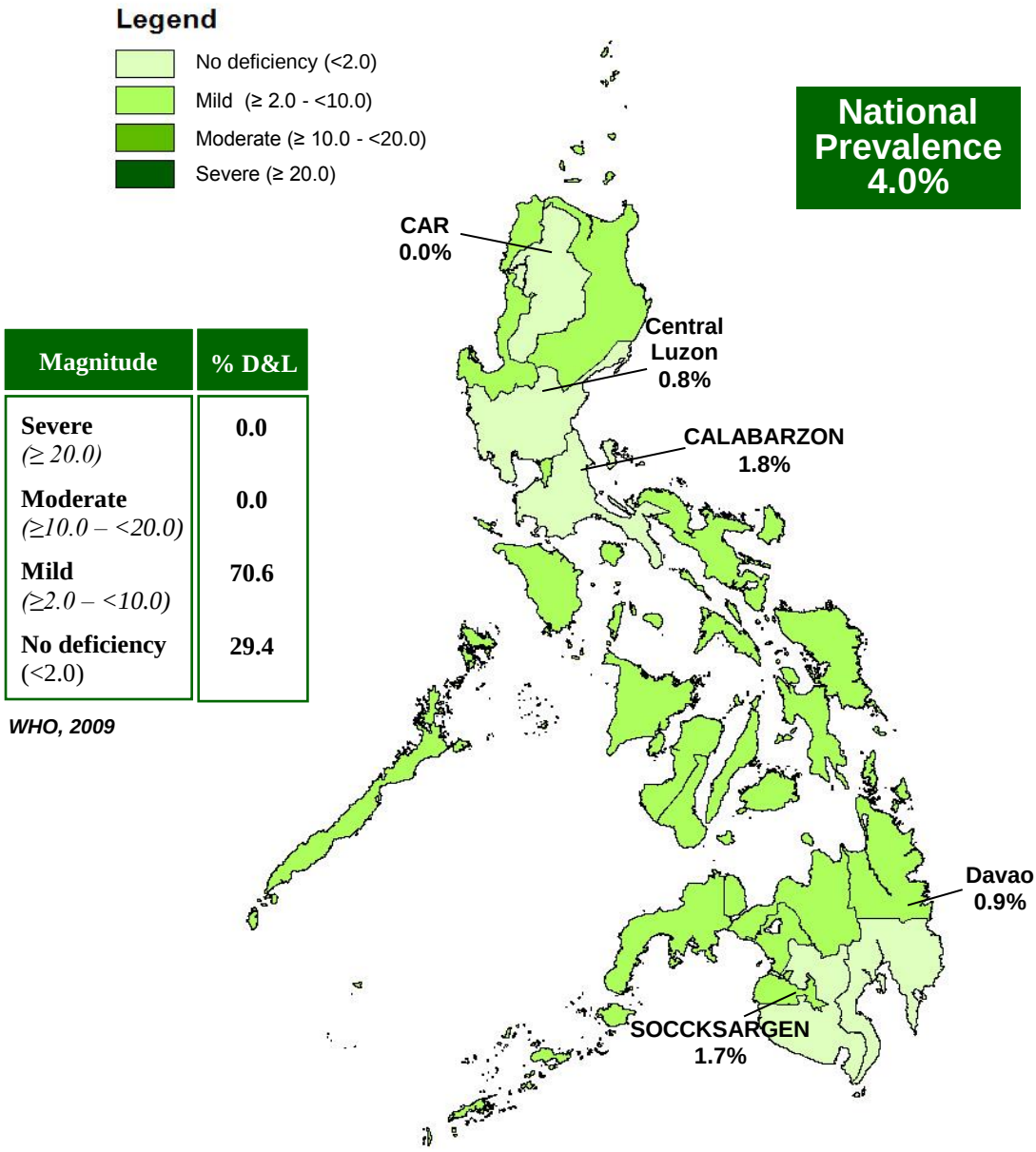
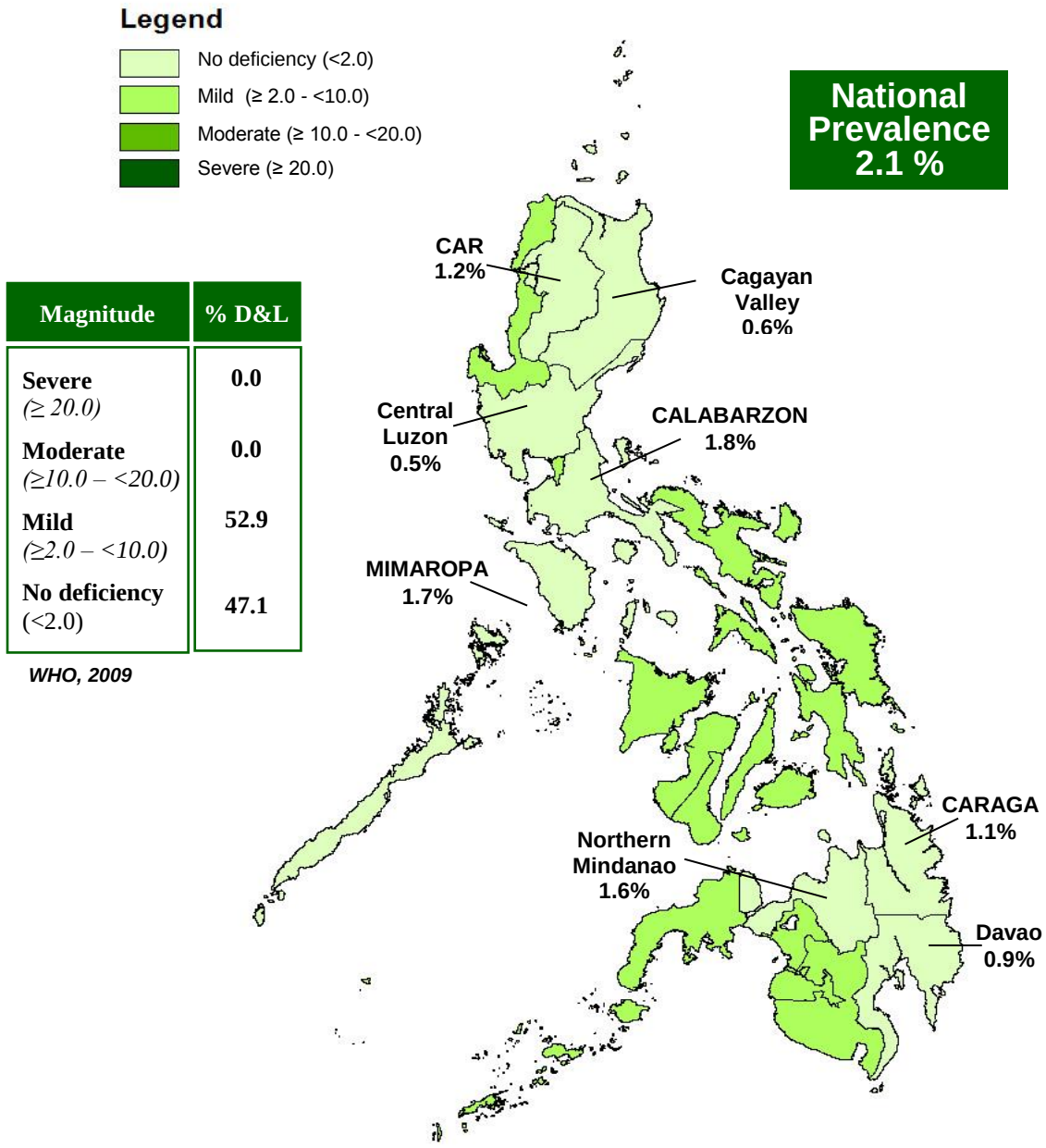


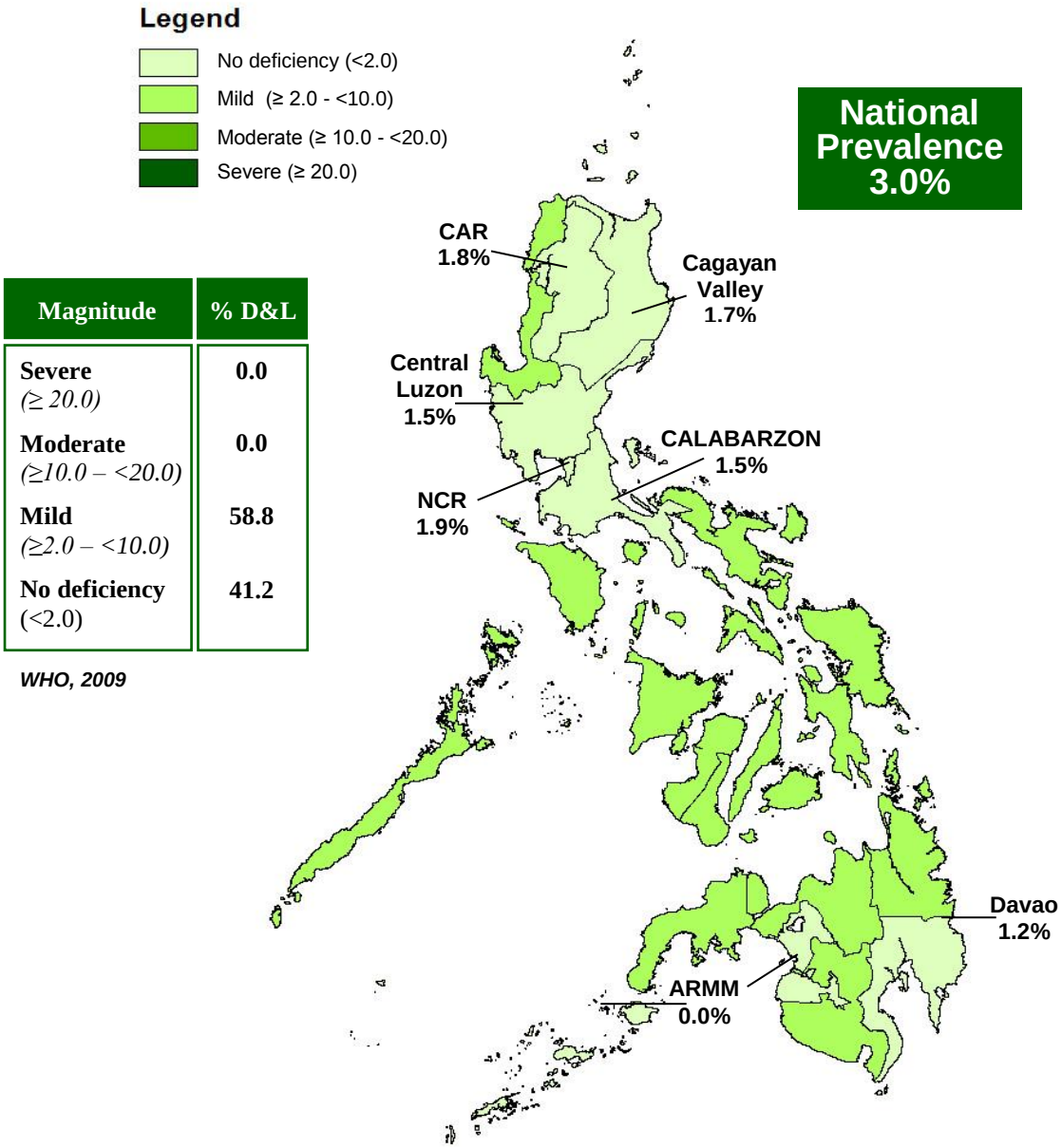
Figure 27. Magnitude of Vitamin A Deficiency (VAD) prevalence among adolescents, 13-19 years by region: Philippines 2013



Magnitude	% D&L
Severe *(≥ 20.0)*	**0.0**
Moderate *(≥10.0 – <20.0)*	**0.0**
Mild *(≥2.0 – <10.0)*	**52.9**
No deficiency (<2.0)	**47.1**

WHO, 2009

Figure 28. Magnitude of Vitamin A Deficiency (VAD) prevalence among adults, 29-59 years by region: Philippines 2013



Magnitude	% D&L
Severe *(≥ 20.0)*	**0.0**
Moderate *(≥10.0 – <20.0)*	**0.0**
Mild *(≥2.0 – <10.0)*	**58.8**
No deficiency (<2.0)	**41.2**

WHO, 2009

Figure 29. Magnitude of Vitamin A Deficiency (VAD) prevalence among the elderly, ≥ 60 years by region: Philippines 2013

3.4.1 Prevalence of Vitamin A Deficiency (VAD) by Place of Residence

Vitamin A deficiency is higher in the rural areas compared to those in the urban areas (20.7 % vs 20.1%) (Figure 30). Among the different age and physiologic groups, prevalence was higher in the rural areas compared to those in the urban areas except among the 13-19 year old group and the pregnant women.

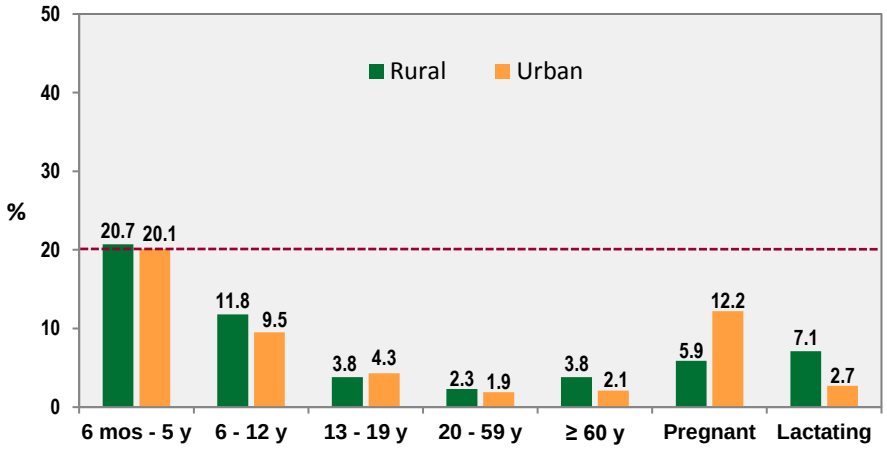


Figure 30. Prevalence of Vitamin A deficiency (VAD) by age, physiologic group and by place of residence: Philippines, 2013

3.4.3 Prevalence of VAD among children by Wealth Quintile

By wealth quintile, among the children 6 months–5 years, highest VAD prevalence was observed among the poorest and lowest among the richest (Figure 31). The same trend was observed among the adults, but not among the elderly (Figure 32). This trend was not evident among the 6-12, 13-19 year old age groups. No trend was also observed among the pregnant women, as the highest was among the poorest at 15.1%, lowest among the middle income group at 1.9% and was higher among the rich at 8.1% (Figure 33). Among the lactating mothers, VAD was highest among the richest and lowest among the poorest.

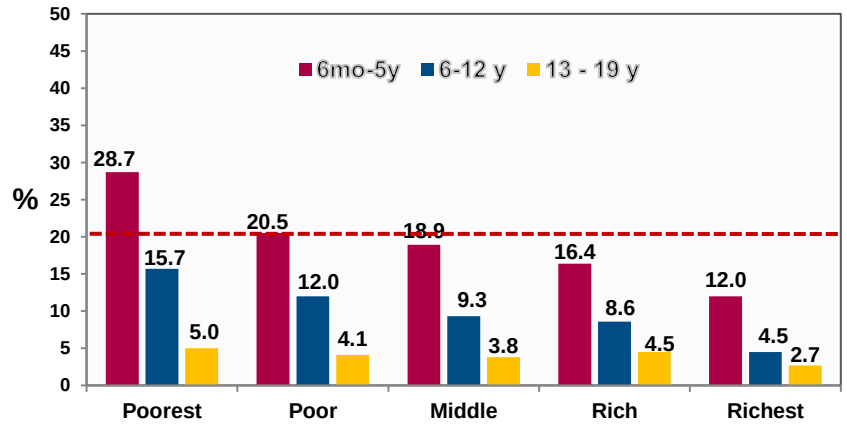


Figure 31. Prevalence of Vitamin A Deficiency (VAD) among children by wealth quintile: Philippines, 2013

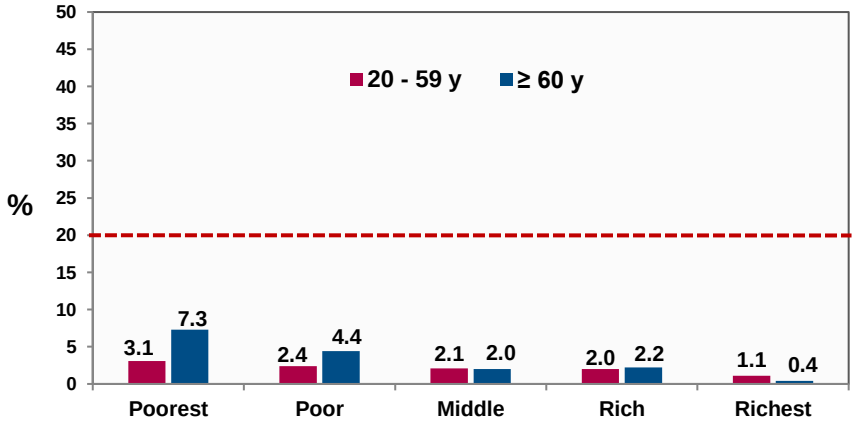


Figure 32. Prevalence of Vitamin A Deficiency (VAD) among adults and the elderly by wealth quintile: Philippines, 2013

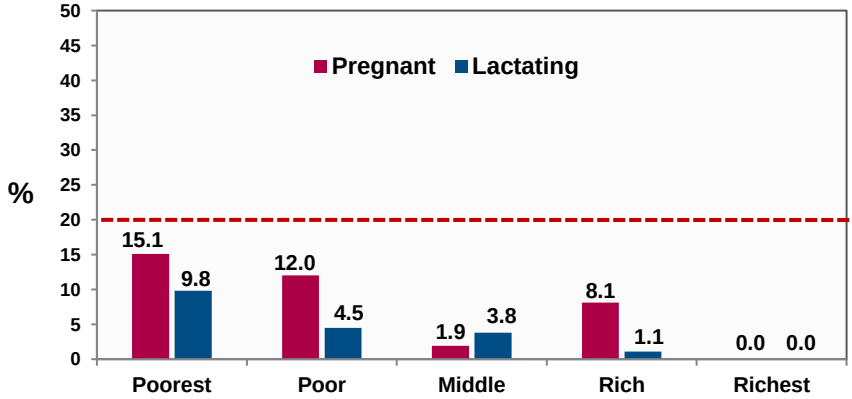


Figure 33. Prevalence of Vitamin A Deficiency (VAD among pregnant women and lactating mothers by wealth quintile: Philippines, 2013

3.4.4 Trends in VAD: 1993, 1998, 2003, 2008 and 2013

The prevalence of VAD among the preschool children was 20.4% which is a problem of "severe" public health significance (Figure 34). This is higher than that found in the 2008 NNS which was 15.2%. VAD was a "severe" public health problem from 1993 to 2003. Prevalence steadily increased from 35.3% in 1993 to 40.1% in 2003. There was a significant decline from 40.1% in 2003 to 15.2% in 2008.

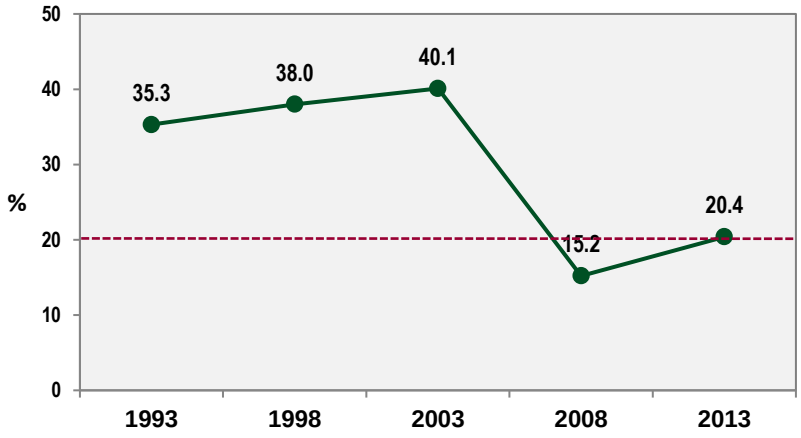


Figure 34. Trend in the prevalence of vitamin A deficiency (VAD) among preschool children, 6 months – 5 years: Philippines, 1993, 1998, 2003, 2008 and 2013

In the 2013 NNS, VAD among the pregnant women is 9.0% (Figure 35). This is lower than the VAD prevalence in the previous surveys. VAD prevalence was 16.4% in 1993 but increased to 22.2% in 1998. This was the highest prevalence recorded for the pregnant women. In 2003, the prevalence rate decreased to 17.5%, further decreasing to 9.5% in 2008. VAD prevalence was considered a "severe" public health problem in 1998 and "moderate" public health problem in the 1993, and 2003 surveys. The lowest prevalence was recorded in 2008 but still considered a "mild" problem health problem. VAD prevalence further declined to 9.0% in the 2013 NNS.

VAD prevalence among the lactating women is 5.0% (Figure 35) in 2013. This is lower than the VAD prevalence in the previous surveys. VAD prevalence was similar in the 1993 and 1998 at 16.4% and 16.5%, respectively. These levels were considered "moderate" but it increased to 20.1% in 2003, a level considered "severe" public health problem. A sharp decline in VAD prevalence was recorded from 2003 to 2008. It was 6.4% in 2008, a level considered "mild". This further declined to 5.0% in the 2013 NNS.

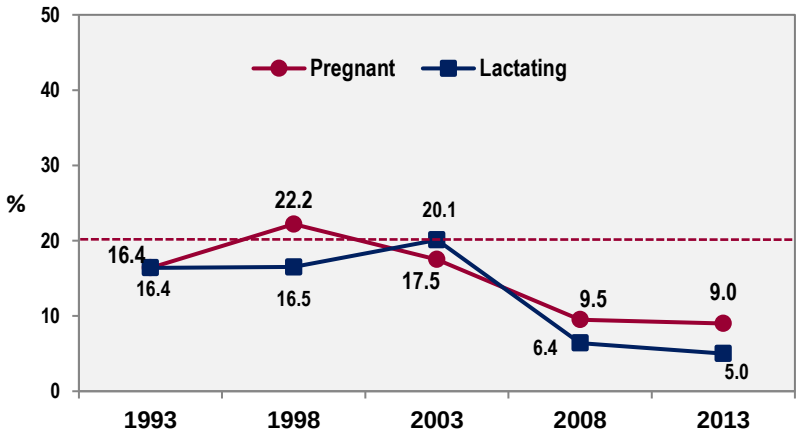


Figure 35. Trends in the prevalence of vitamin A deficiency (VAD) among pregnant women and lactating mothers: Philippines 1993, 1998, 2003, 2008 and 2013

Figure 36 shows the distribution of retinol values among preschool children in the 1992, 1998, 2008 and 2013 NNS series. Distribution of values has slowly shifted towards acceptable levels in the 1993, 1998, 2003, 2008 and 2013 NNS series. In 1993, 40% of the children had acceptable or normal retinol levels ranging from 20 to 59 ug/dL. This increased by 57.0% in 1998, 58.5% in 2003, 77.0% in 2008 and 78.4% in 2013. This showed a steady increase in retinol concentration towards acceptable levels.

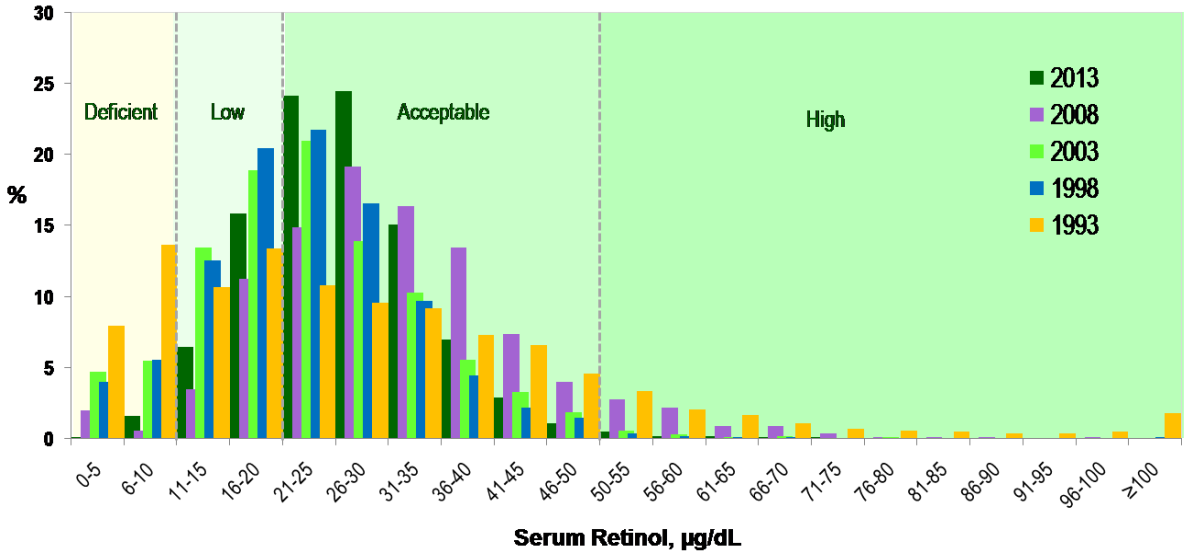


Figure 36. Distribution of serum retinol levels among preschool children, Philippines: 1993, 1998, 2003, 2008 and 2013

3.5 Vitamin D Deficiency

Total serum 25-hydroxyvitamin D [(25-OH(D)] was determined for vitamin D deficiency. The cut-off for interpretation of results is shown in Table 13.

Of the 5 areas (NCR and the provinces of Cebu, Davao, Cagayan and Benguet) included in the vitamin D survey, over-all mean vitamin D levels were highest in Cagayan and lowest in Benguet, for all age and sex groups with vitamin D levels of 107.8 ± 3.6 nmol/L and 73.3 ± 1.3 nmol/L, respectively. The highest proportion of deficient and insufficient levels was found in Benguet at 60.3% and lowest in Cagayan at 19.5%. Generally, males had higher vitamin D levels compared to their female counterparts. There were more deficient and insufficient levels among the females compared to the males.

Over all vitamin D level in the NCR was 76.2 ± 0.9 nmol/L and the proportion of deficient to insufficient level was 54.1% (Table 22). The lowest mean vitamin D levels were found among the females 20-39 years old (63.5 ± 1.7 nmol/L) and highest was among the elderly males (95.5 ± 5.0 nmol/L). Prevalence of deficient and insufficient levels were highest (73.4%) among the 20-39 year old females and lowest (26.1%) was among the male elderly adults.

Over all vitamin D level in Cagayan was 107.8 ± 3.6 nmol/L and the proportion of deficient to insufficient level was 19.5% (Table 23). The lowest mean vitamin D levels were found among the females 20-39 years old (84.6 ± 2.3 nmol/L) and highest was among 40-59 year old males (134.1 ± 2.3 nmol/L). Prevalence of deficient and insufficient levels were highest (43.1%) among the 20-39 year old females and lowest (1.6%) among the 40-59 years old male population.

Over all vitamin D level in Benguet was 73.3 ± 1.3 nmol/L and the proportion of deficient to insufficient level was 60.3% (Table 24). The lowest mean vitamin D levels were found among the females 20-39 years old (57.5 ± 2.8 nmol/L) and highest was among 40-59 year old males (87.8 ± 1.5 nmol/L). Prevalence of deficient and insufficient levels were highest (86.7%) among the 40-59 year old females and lowest (27.8%) was among the 40-59 years old male population.

Over-all vitamin D level in Cebu was 85.7 ± 2.0 nmol/mL and the proportion of deficient and insufficient level was 43.7% (Table 25). Highest mean level (108.3± 2.9 nmol/L) was among the 40-59 year old males with 21.2% having deficient and insufficient levels. Lowest level (65.5 ± 1.8%) was among the 20-39 years old females with 71.8% having deficient and insufficient levels.

Over-all vitamin D level in Davao was 98.8 ± 2.4 nmol/L and the proportion of deficient and insufficient level was 28.9% (Table 26). Highest level (117.7 ± 3.2 nmol/L) was among the 40-59 year old males with 10.1% having deficient and insufficient levels. Lowest level (78.1 ± 3.5 nmol/L) was among the 20-39 year old females with 54.2% having deficient and insufficient levels.

Table 22. Mean vitamin D levels and frequency distribution by age andsex: National Capital Region, Philippines, 2013

Sex/Age	n	Vitamin D Mean ± SE	Vitamin D Status					
			<50		50 - <75		≥75	
			freq	%	freq	%	freq	%
Male	648	85.9 ± 1.3	57	10.9	181	28.6	410	60.6
20-39	302	78.7 ± 1.8	37	13.3	107	35.3	158	51.5
40-59	254	93.6 ± 2.3	14	8.0	58	22.2	182	69.8
60 and above	92	95.5 ± 5.0	6	8.8	16	17.3	70	73.9
Female	798	68.1 ± 1.3	169	22.5	348	43.6	281	33.9
20-39	320	63.5 ± 1.7	105	31.9	133	41.5	82	26.7
40-59	329	70.3 ± 1.1	50	16.1	150	46.7	129	37.2
60 and above	149	77.1 ± 1.9	14	9.3	65	42.3	70	48.4
All	1446	76.2 ± 0.9	226	17.3	529	36.8	691	45.9
20-39	622	70.8 ± 1.3	142	23.0	240	38.5	240	38.6
40-59	583	80.5 ± 1.3	64	12.5	208	36.0	311	51.4
60 and above	241	84.2 ± 2.5	20	9.1	81	32.6	140	58.3

Deficient <50 nmol/mL; Insufficient 50-<75 nmol/mL; Sufficient ≥ 75 nmol/mL

Table 23. Mean Vitamin D levels and frequency distribution by age and sex: Cagayan, Philippines, 2013

Sex/Age	n	Vitamin D Mean ± SE	Vitamin D Status					
			<50		50 - <75		≥75	
			freq	%	freq	%	freq	%
Male	141	127.0 ± 4.3	2	2.0	4	3.5	135	94.6
20-39	54	120.8 ± 7.6	2	4.2	3	6.2	49	89.6
40-59	61	134.1 ± 2.3	0	0	1	1.6	60	98.4
60 and above	26	129.0 ± 4.1	0	0	0	0	26	100.0
Female	162	90.1 ± 2.1	6	4.2	44	28.2	112	67.7
20-39	54	84.6 ± 3.3	5	8.5	18	34.6	31	56.9
40-59	68	96.2 ± 2.7	1	1.6	14	20.8	53	77.7
60 and above	40	89.7 ± 2.8	0	0	12	29.5	28	70.5
All	303	107.8± 3.6	8	3.1	48	16.4	247	80.4
20-39	108	102.7 ± 6.1	7	6.4	21	20.4	80	73.2
40-59	129	114.3 ± 3.0	1	0.8	15	11.6	113	87.6
60 and above	66	105.6 ± 2.4	0	0	12	17.6	54	82.4

Deficient <50 nmol/mL; Insufficient 50-<75 nmol/mL; Sufficient ≥ 75 nmol/mL

Table 24. Mean Vitamin D levels and frequency distribution by age and sex: Benguet, Philippines, 2013

Sex/Age	n	Vitamin D Mean ± SE	Vitamin D Status					
			<50		50 - <75		≥75	
			freq	%	freq	%	freq	%
Male	100	85.3 ± 2.3	14	13.8	25	25.0	61	61.2
20-39	43	84.4 ± 4.2	7	15.4	13	30.0	23	54.6
40-59	38	87.8 ± 1.5	6	14.2	5	13.6	27	72.2
60 and above	19	82.5 ± 6.2	1	7.4	7	34.9	11	57.7
Female	118	63.4 ± 0.9	23	21.8	66	56.1	29	22.2
20-39	49	57.5 ± 2.8	15	30.5	27	56.2	7	13.3
40-59	38	69.3 ± 3.0	4	11.6	23	59.9	11	28.5
60 and above	31	70.2 ± 4.3	4	13.9	16	50.3	11	35.9
All	218	73.3 ± 1.3	37	18.2	91	42.1	90	39.7
20-39	92	69.4 ± 3.1	22	23.8	40	44.5	30	31.6
40-59	76	78.4 ± 2.6	10	12.9	28	37.0	38	50.1
60 and above	50	75.0 ± 4.8	5	11.4	23	44.3	22	44.3

Deficient <50 nmol/mL; Insufficient 50-<75 nmol/mL; Sufficient ≥ 75 nmol/mL

Table 25. Mean Vitamin D levels and frequency distribution by age and sex: Cebu, Philippines, 2013

Sex/Age	n	Vitamin D Mean ± SE	Vitamin D Status					
			<50		50 - <75		≥75	
			freq	%	freq	%	freq	%
Male	270	104.1 ± 4.1	9	3.5	48	18.5	213	78.8
20-39	102	100.1 ± 5.6	4	3.8	20	19.9	78	76.3
40-59	119	108.3 ± 2.9	3	2.9	21	18.3	95	78.8
60 and above	49	105.0 ± 6.4	2	4.2	7	14.4	40	81.4
Female	345	71.0 ± 1.5	54	17.6	149	43.6	142	38.8
20-39	117	65.5 ± 1.8	28	24.6	55	47.2	34	28.2
40-59	164	74.4 ± 2.4	21	14.0	65	39.1	78	47.0
60 and above	64	77.4 ± 2.0	5	7.1	29	46.4	30	46.5
All	615	85.7 ± 2.0	63	11.3	197	32.4	355	56.2
20-39	219	81.3 ± 2.5	32	15.1	75	34.8	112	50.1
40-59	283	88.9 ± 2.4	24	9.2	86	30.2	173	60.6
60 and above	113	90.0 ± 3.2	7	5.8	36	31.8	70	62.4

Deficient <50 nmol/mL; Insufficient 50-<75 nmol/mL; Sufficient ≥ 75 nmol/mL

Table 26. Mean Vitamin D levels and frequency distribution by age and sex: Davao, Philippines, 2013

Sex/Age	n	Vitamin D Mean ± SE	Vitamin D Status					
			<50		50 - <75		≥75	
			freq	%	freq	%	freq	%
Male	296	114.4 ± 2.3	4	1.4	29	10.1	263	88.5
20-39	135	112.0 ± 2.8	3	2.1	15	11.4	117	86.5
40-59	119	117.7 ± 3.2	1	0.9	11	9.2	107	89.9
60 and above	42	114.6 ± 4.4	0	0	3	6.8	39	93.2
Female	310	84.0 ± 2.6	24	8.1	113	37.3	173	54.5
20-39	132	78.1 ± 3.5	16	12.0	56	42.2	60	45.8
40-59	132	90.5 ± 4.5	5	3.7	46	34.6	81	61.7
60 and above	46	89.0 ± 5.2	3	5.4	11	24.4	32	70.1
All	606	98.8 ± 2.4	28	4.9	142	24.0	436	71.1
20-39	267	94.9 ± 3.2	19	7.1	71	26.9	177	66.0
40-59	251	103.5 ± 3.5	6	2.4	57	22.4	188	75.2
60 and above	88	101.5 ± 3.8	3	2.8	14	15.9	71	81.3

Deficient <50 nmol/mL; Insufficient 50-<75 nmol/mL; Sufficient ≥ 75 nmol/mL

3.6 Zinc Deficiency

Serum zinc was determined as the parameter for zinc status. Cut-off for interpretation of results is shown in Tables 14 and 15. The over-all prevalence of zinc deficiency is 25.6%, which is considered a “high” public health concern (Figure 37).

Highest prevalence of deficiency was observed among the elderly, aged 60 years and above at 36.3%, followed by the adults 20-59 years and the lactating mothers at 28.1% and 25.2% respectively. Prevalence of deficiency among these groups, as well as that of the school children and adolescents is considered a “high” public health concern. Lowest prevalence of zinc deficieny was recorded among the pregnant women at 13.7% followed by the preschool children at 17.9%. Zinc deficiency among these groups is “moderately high”.

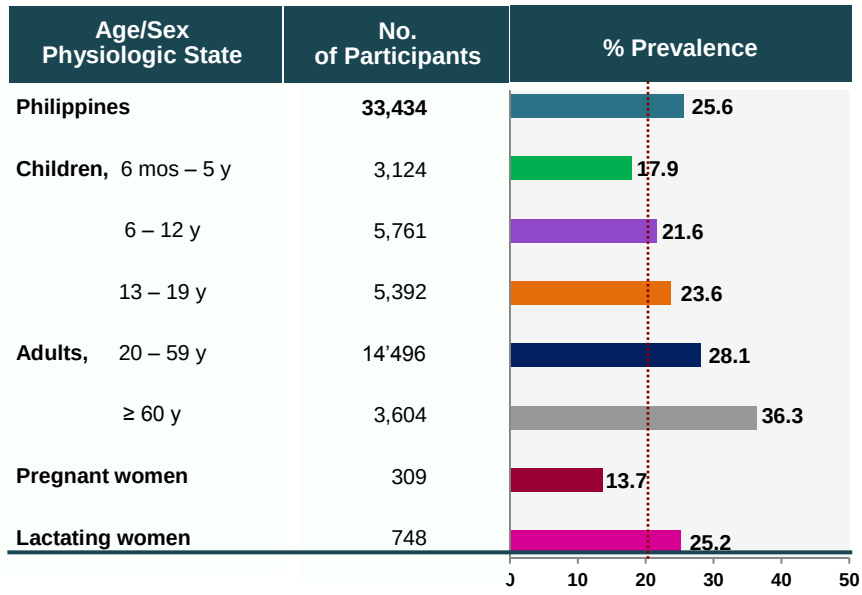


Figure 37. Prevalence of zinc deficiency by age and physiologic state: Philippines, 2013

3.6.1 Zinc deficiency by sex and physiologic group

Prevalence of zinc deficiency among males was higher than among females in the different age groups: school children aged 6-12 years, adolescents aged 13-19 years and the elderly aged 60 years and above (Table 27). Among the adults, prevalence of zinc deficiency was slightly higher among the females compared to the males. Mean zinc levels was similar for the male and female 6-12 year old children and the elderly; zinc levels was higher among the male adolescents 13-19 years old and adults compared to the females.

Over-all prevalence of zinc deficiency among the pregnant women was 13.7% and mean zinc level was 66.2 ± 1.0 ug/dL (Table 27). Prevalence of zinc deficiency increased as pregnancy progressed from 8.3%, 11.9% and 18.3%, for the first, second and third trimester respectively. Mean zinc levels decreased from the first to the third trimester.

Over-all prevalence of zinc deficiency among the lactating mothers was 25.2% and mean zinc level was 76.0 ± 0.7 ug/dL (Table 27). Prevalence of zinc deficiency was 29.4% during the first 6 months of lactation with a mean zinc level of 73.8 ± 1.1 ug/dL, but decreased to 22.4% during the second six months of lactation. Mean zinc level was higher for the mothers on their second 6 months of lactation at 76.1 ± 1.1 ug/dL and highest for the mothers who were lactating for more than a year with zinc level of 78.3 ± 1.4 ug/dL.

Table 27. Serum zinc level and prevalence of zinc deficiency by age and physiologic state: Philippines, 2013

Age/ Physiologic State	n	Serum zinc, µg/dL Mean ± SD	% Prevalence
Philippines	33,434	80.5 ± 0.3	25.6
Children			
6 mos - 5 y	3,124	82.1 ± 0.6	17.9
6 - 12 y	5,761	79.5 ± 0.4	21.6
Male	2,975	79.7 ± 0.5	24.1
Female	2,786	79.3 ± 0.5	18.9
13 - 19 y	5,392	79.8 ± 0.5	23.6
Male	2,843	81.3 ± 0.5	25.0
Female	2,549	78.2 ± 0.5	22.0
Adults	14,496	81.9 ± 0.4	28.1
Male	7,357	84.6 ± 0.4	27.8
Female	7,139	79.1 ± 0.4	28.4
Elderly	3,604	77.5 ± 0.5	36.3
Male	1,570	77.6 ± 0.6	43.2
Female	2,034	77.5 ± 0.6	30.8
Pregnant	309	66.2 ± 1.0	13.7
1st Trimester	60	73.9 ± 2.1	8.3
2nd Trimester	121	66.0 ± 1.6	11.9
3rd Trimester	128	62.6 ± 1.9	18.3
Lactating	748	76.0 ± 0.7	25.2
1st 6 mos	285	73.8 ± 1.1	29.4
Next 6 mos	197	76.1 ± 1.1	22.4
> 1 yr	266	78.3 ± 1.4	23.0

3.6.2 Mean levels and prevalence of zinc deficiency by island group

By island groups, highest mean zinc level among all age/physiologic groups was recorded in Luzon with 82.3 ± 0.5 ug/dL, followed by Visayas with 79.2 ± 0.5 ug/dL. Mindanao had the lowest mean zinc level at 77.2 ± 0.5 ug/dL (Table 28). On the other hand, highest prevalence of zinc deficiency was in Mindanao at 27.2%, followed by Visayas at 79.2% then Luzon at 18.6%.

Among the preschool children aged 5 months to 5 years, schoolchildren aged 6 to 12 years and adolescents 13-19 years, highest mean zinc level was recorded in Luzon and lowest was in Mindanao. Highest prevalence of zinc deficiency was recorded in Mindanao and lowest was in Luzon. The same trend was recorded among the adults and the elderly.

Table 28. Prevalence of zinc deficiency by age/physiologic state and by Island group: Philippines, 2013

Age/ Physiologic State	Luzon			Visayas			Mindanao		
	n	Serum Zn, µg/dL Mean ± SD	% Prev	n	Serum Zn, µg/dL Mean ± SD	% Prev	n	Serum Zn, µg/dL Mean ± SD	% Prev
Philippines	17,158	82.3 ± 0.5	18.6	6,429	79.2 ± 0.5	22.2	9,847	77.2 ± 0.5	27.2
Children									
6 mos - 5 y	1,612	85.6 ± 0.8	12.8	530	79.6 ± 1.2	20.1	982	75.5 ± 1.0	28.6
6 - 12 y	2,889	82.4 ± 0.6	16.6	1,062	77.8 ± 0.9	24.2	1,810	74.0 ± 0.7	31.1
13 - 19 y	2,687	81.0 ± 0.7	22.3	1,095	79.2 ± 0.8	22.6	1,610	77.5 ± 0.7	27.5
Adult	7,535	83.0 ± 0.6	25.8	2,757	80.8 ± 0.5	28.4	4,204	79.8 ± 0.6	33.9
Elderly	1,916	77.1 ± 0.7	34.5	779	76.4 ± 0.7	36.6	909	76.0 ± 0.8	41.4
Pregnant	159	67.7 ± 1.4	12.7	43	63.8 ± 2.0	11.2	107	64.0 ± 1.5	24.4
Lactating	360	78.8 ± 1.1	19.1	163	72.3 ± 1.2	31.2	225	72.8 ± 1.3	34.3

3.6.3 Prevalence of zinc deficiency by place of residence

Prevalence of zinc deficiency was higher in the rural areas among the preschool children, school children and the lactating mothers (Figure 38). Among the adolescents, adults and the elderly, prevalence of zinc deficiency was slightly higher in the urban areas. Among the pregnant women, deficiency was similar in the rural and urban areas.

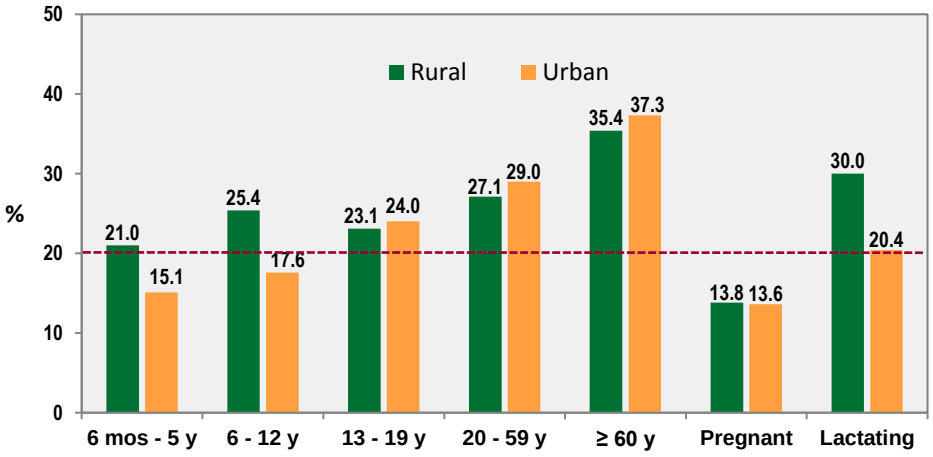


Figure 38. Prevalence of zinc deficiency by age, physiologic group and by place of residence: Philippines, 2013

3.6.4 Prevalence of zinc deficiency by wealth quintile

Prevalence of zinc deficiency was highest among the poorest for the preschool children, school children and adolescents (Figure 39). Among the preschool children and school children, prevalence of deficiency was highest among the poorest and lowest among the richest. This trend was not observed among the adolescents where the lowest prevalence was observed among the middle wealth quintile group.

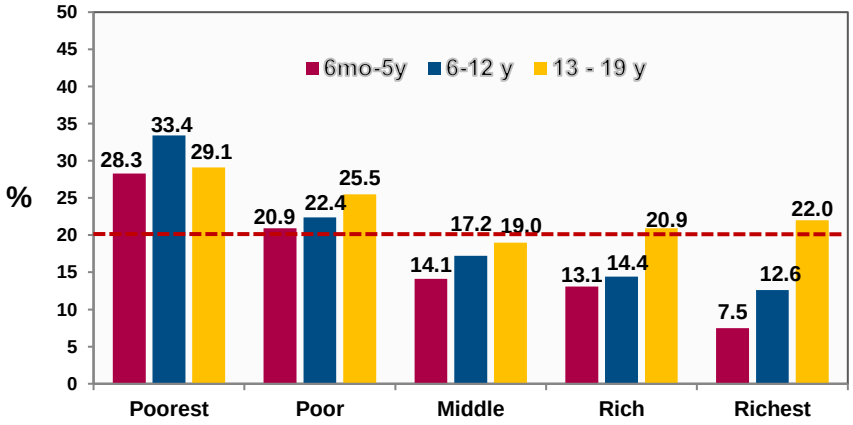


Figure 39. Prevalence of zinc deficiency among children by wealth quintile: Philippines, 2013

Among the elderly population, the prevalence of zinc deficiency was highest among the poorest quintile at 46.0% and in descending trend of deficiency with increasing wealth quintile (Figure 40). The same trend was recorded among the adult population.

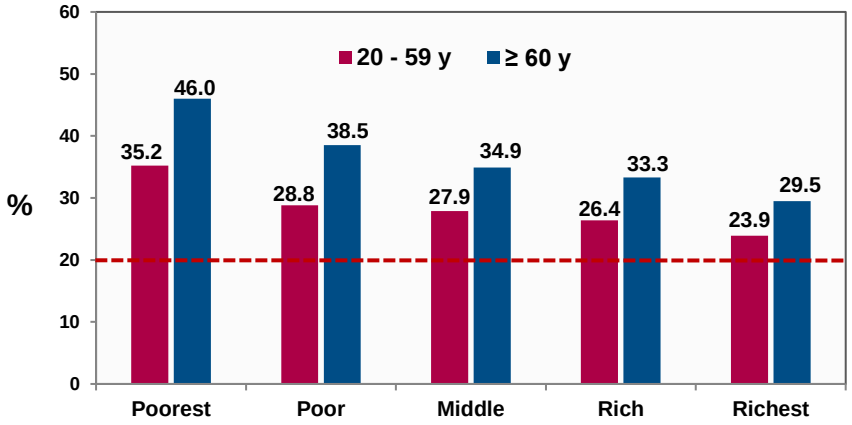


Figure 40. Prevalence of zinc deficiency among adults and the elderly by wealth quintile: Philippines, 2013

Prevalence of zinc deficiency was highest in the middle wealth quintile group among the pregnant women at 17.0%, and lowest among the richest at 7.5% (Figure 41). Among the lactating mothers, prevalence of deficiency was highest among the poorest at 33.4% and lowest among the rich (Figure 41).

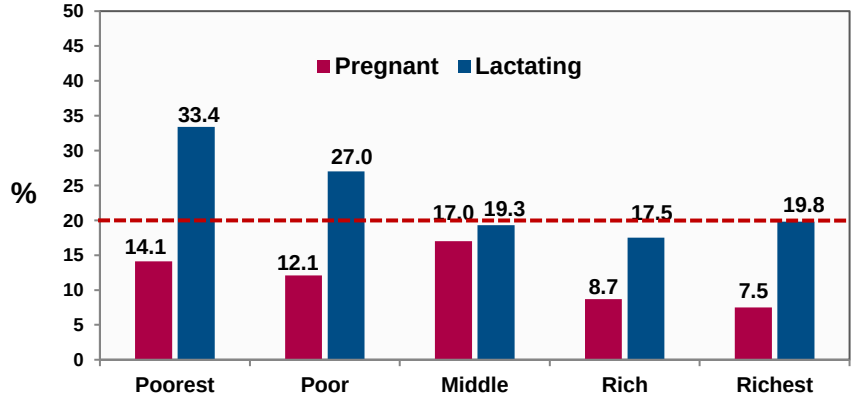


Figure 41. Prevalence of zinc deficiency among pregnant women and lactating mothers by wealth quintile: Philippines, 2013

3.6.5 Prevalence of zinc deficiency: Philippines 2008 and 2013

Serum zinc level was first determined as a parameter of zinc deficiency in the 2008 NNS. Over-all, the prevalence of zinc deficiency was higher in 2008 than in 2013 (30.0% vs 25.6%) (Figure 42) except among the elderly where the prevalence was higher in 2013.

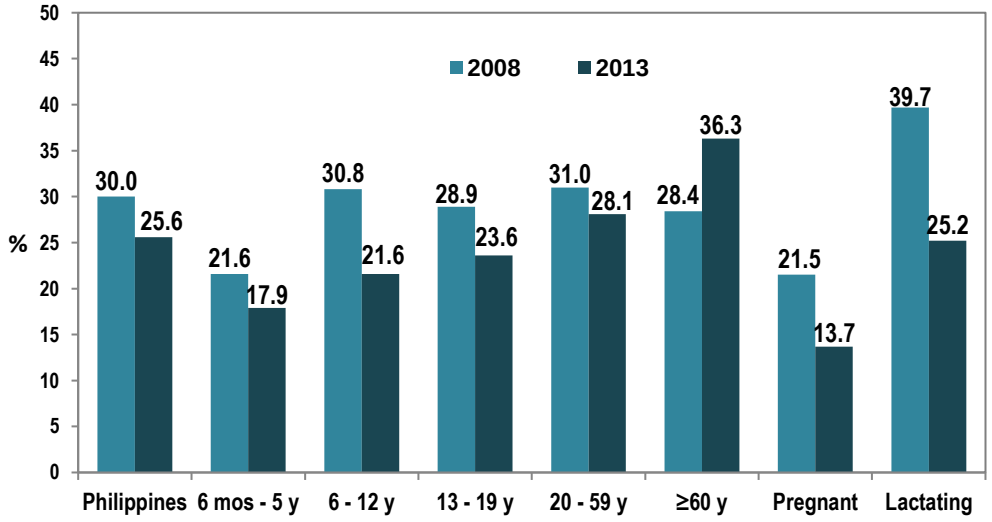


Figure 42. Trends in the prevalence of zinc deficiency: Philippines 2008 and 2013

3.6.6 Prevalence of Zinc Deficiency by Region

The m ean zinc levels, prevalence of deficiency, and 95% CI by region am ong specific age and physiologic groups are in Appendix 11-15. Regional prevalence for pegnant women and lactating mothers was not com puted due to the small number of samples collected.

Pre-school children: Over-all, the prevalence of zinc deficiency among pre-school children was 17.9% (95% CI 16.3-19.7) (Appendix 11, Figure 43). This prevalence is considered "moderately high". Nine (9) of the regions (CAR, MIMAROPA, Bicol, Western Visayas, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, SOCCSKSARGEN and ARMM) or 52.9% had a deficiency considered as "high" pubic health concern. Three (3) regions (Ilocos, Cagayan Valley, Central Luzon) or 17.7% had "moderate" deficiency prevalence. Five (5) of the regions (NCR, CALABARZON, Central Visayas, Davao, CARAGA) or 29.4% had a prevalence considered "moderately high".

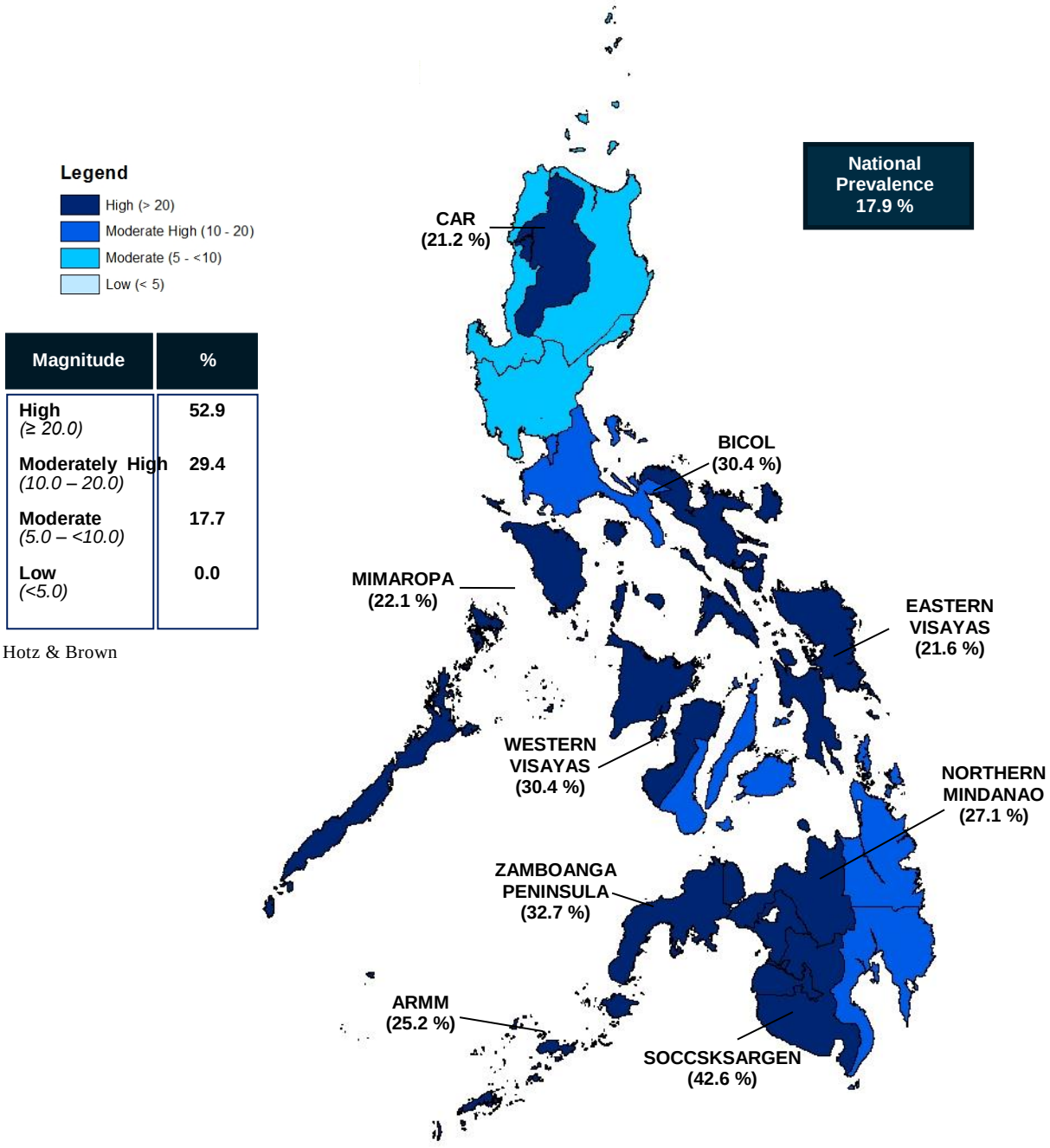
School children: Over-all, the prevalence of zinc deficiency among the school-children was 21.6% (95% CI 19.9-23.4) (Appendix 12, Figure 44). This prevalence is considered "moderately high" public health concern. Eleven (11) of the regions (CAR, MIMAROPA, Bicol,

Western Visayas, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, Davao, SOCCSKSARGEN, ARMM and CARAGA) or 64.7% had a deficiency considered as "high" pubic health concern. Two (2) regions (Ilocos and Central Visayas) or 11.8% had "moderate" deficiency prevalence. Four (4) of the regions (NCR, Cagayan Valley, Central Luzon and CALABARZON) or 23.5% had a prevalence considered "moderately high".

Adolescents: Over-all, the prevalence of zinc deficiency among the adolescents was 23.6% (95% CI 21.8-25.4) (Appendix 13, Figure 45). This prevalence is considered "high" public health concern. Eleven (11) of the regions (NCR, CAR, MIMAROPA, Bicol, Western Visayas, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, SOCCSKSARGEN, ARMM and CARAGA) or 64.7% had a deficiency considered as "high" pubic health concern. Six (6) of the regions (Ilocos, Cagayan Valley, Central Luzon, CALABARZON, Central Visayas and Davao) or 35.3% had a prevalence considered "moderately high" public health concern.

Adults: Over-all, the prevalence of zinc deficiency among the adults was 28.1% (95% CI 26.6-9.6) (Appendix 14, Figure 46). This prevalence is considered "high" public health concern. Twelve (12) of the regions (NCR, CAR, MIMAROPA, Bicol, Western Visayas, Eastern Visayas, Zamboanga Peninsula, Northern Mindanao, Davao, SOCCSKSARGEN, ARMM and CARAGA) or 70.6% had a deficiency considered as "high" pubic health concern. Five (5) of the regions (Ilocos, Cagayan Valley, Central Luzon, CALABARZON and Central Visayas) or 29.4% had a prevalence considered "moderately high" public health concern.

Elderly: Over-all, the prevalence of zinc deficiency among the adults was 36.3% (95% CI 34.1-38.6) (Appendix 15, Figure 47). This prevalence is considered "high" public health concern. All the 17 regions had prevlance considered "high" public health concern.



Magnitude	%
High *(≥ 20.0)*	52.9
Moderately High *(10.0 – 20.0)*	29.4
Moderate *(5.0 – <10.0)*	17.7
Low *(<5.0)*	0.0

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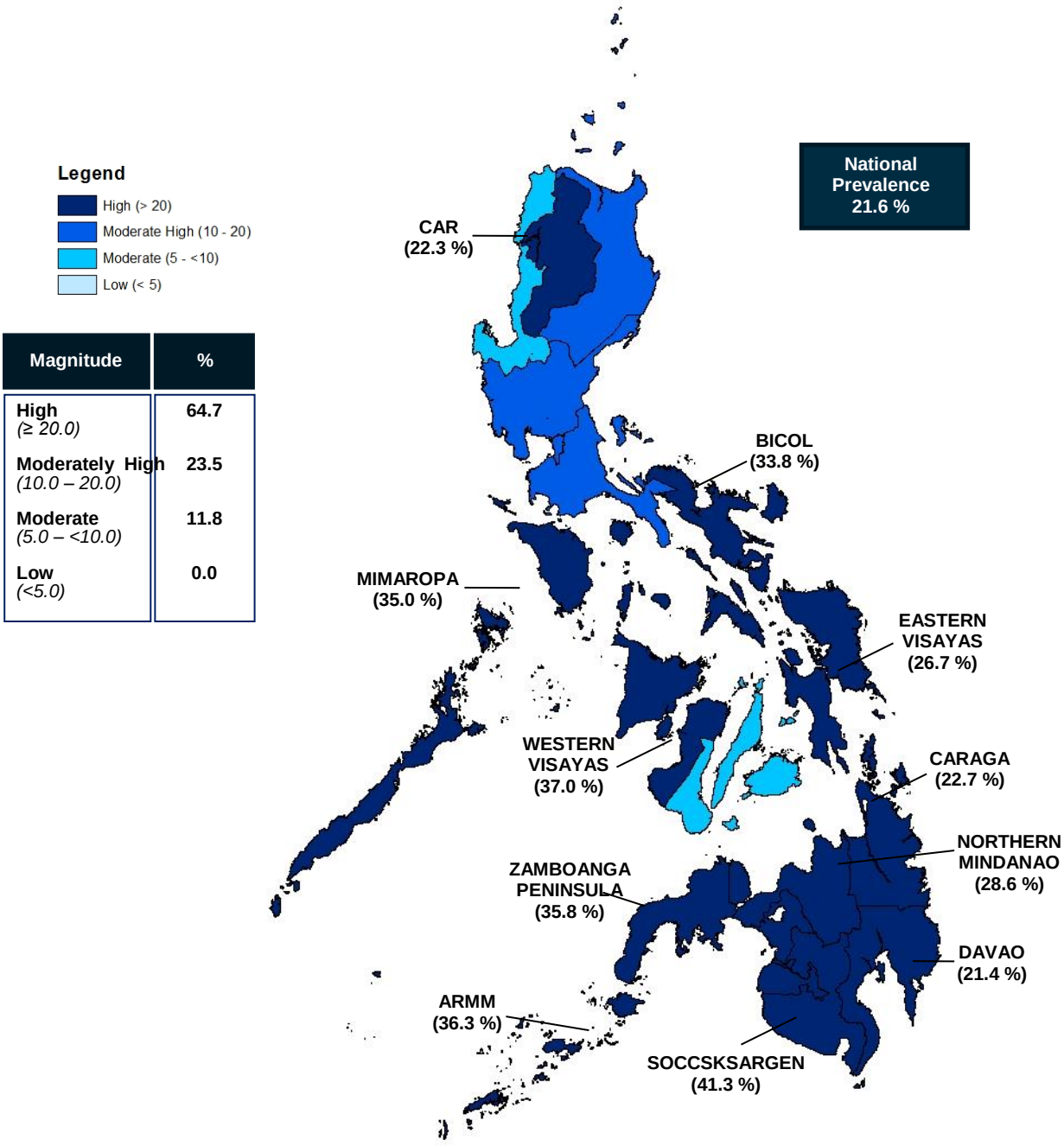
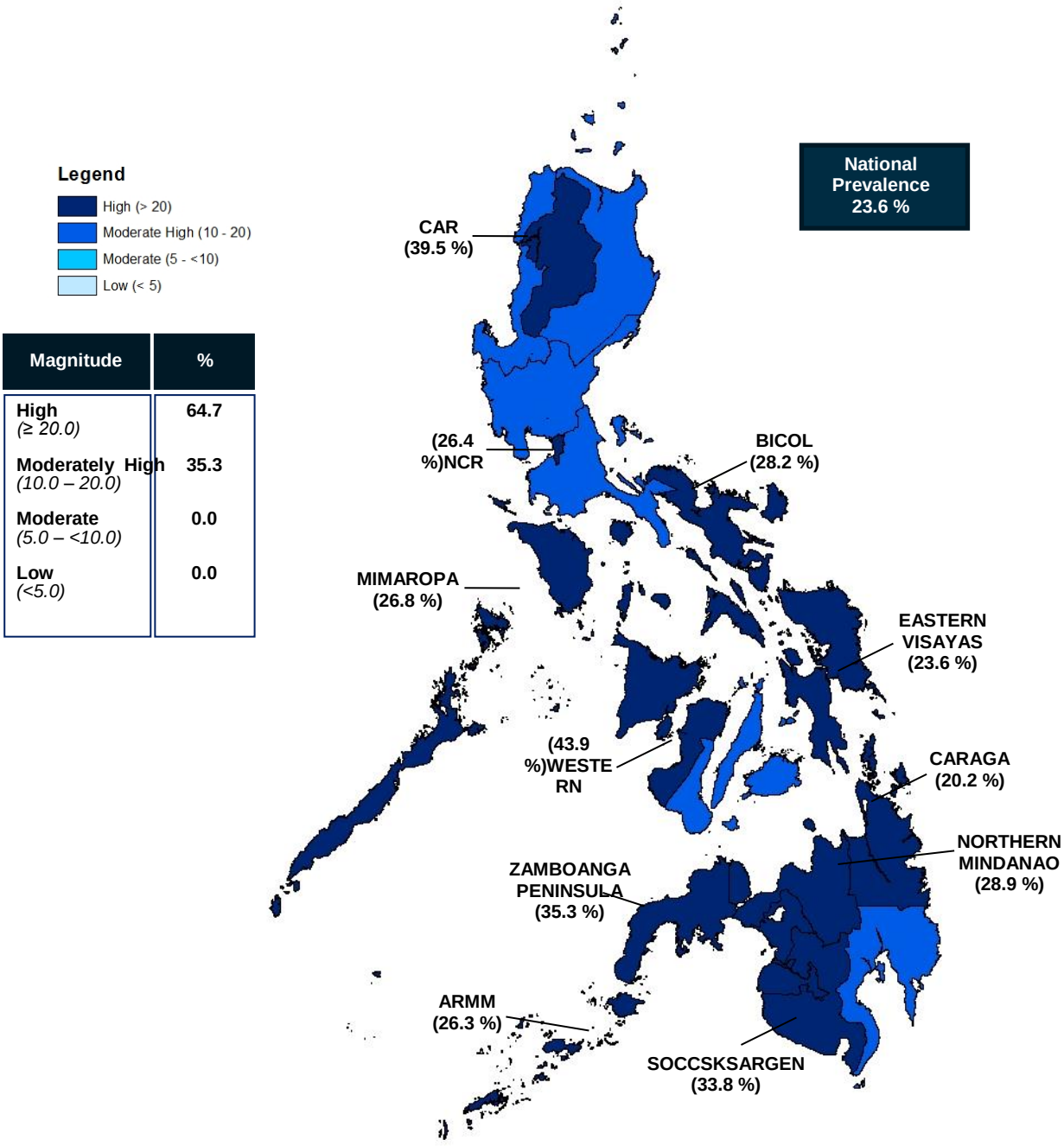
Figure 43. Magnitude of zinc deficiency prevalence among the preschool children, 6 months - 5 years by region: Philippines 2013



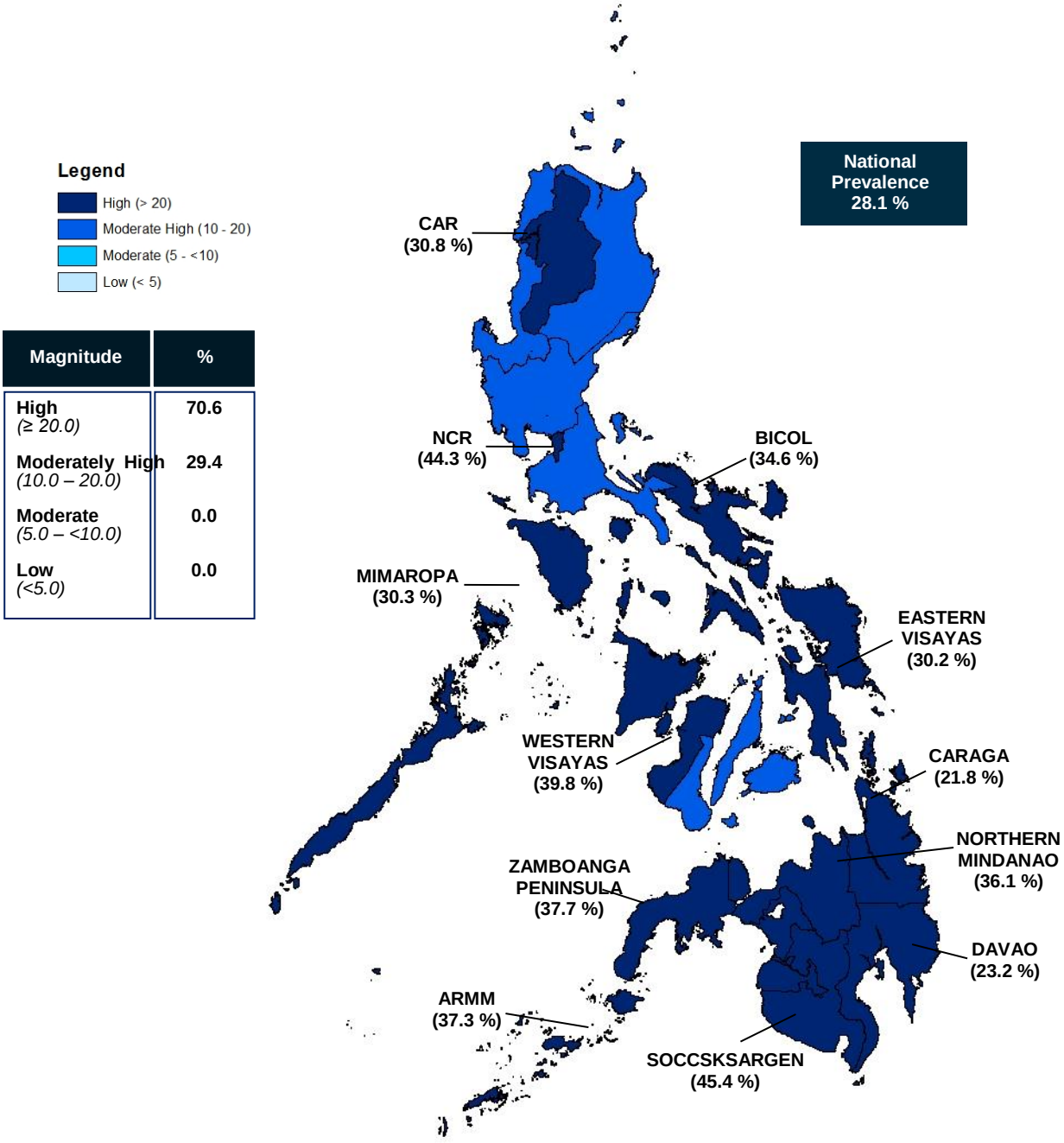
Magnitude	%
High *(≥ 20.0)*	64.7
Moderately High *(10.0 – 20.0)*	23.5
Moderate *(5.0 – <10.0)*	11.8
Low *(<5.0)*	0.0

Figure 44. Magnitude of zinc deficiency prevalence among the school children, 6 - 12 years by region: Philippines 2013



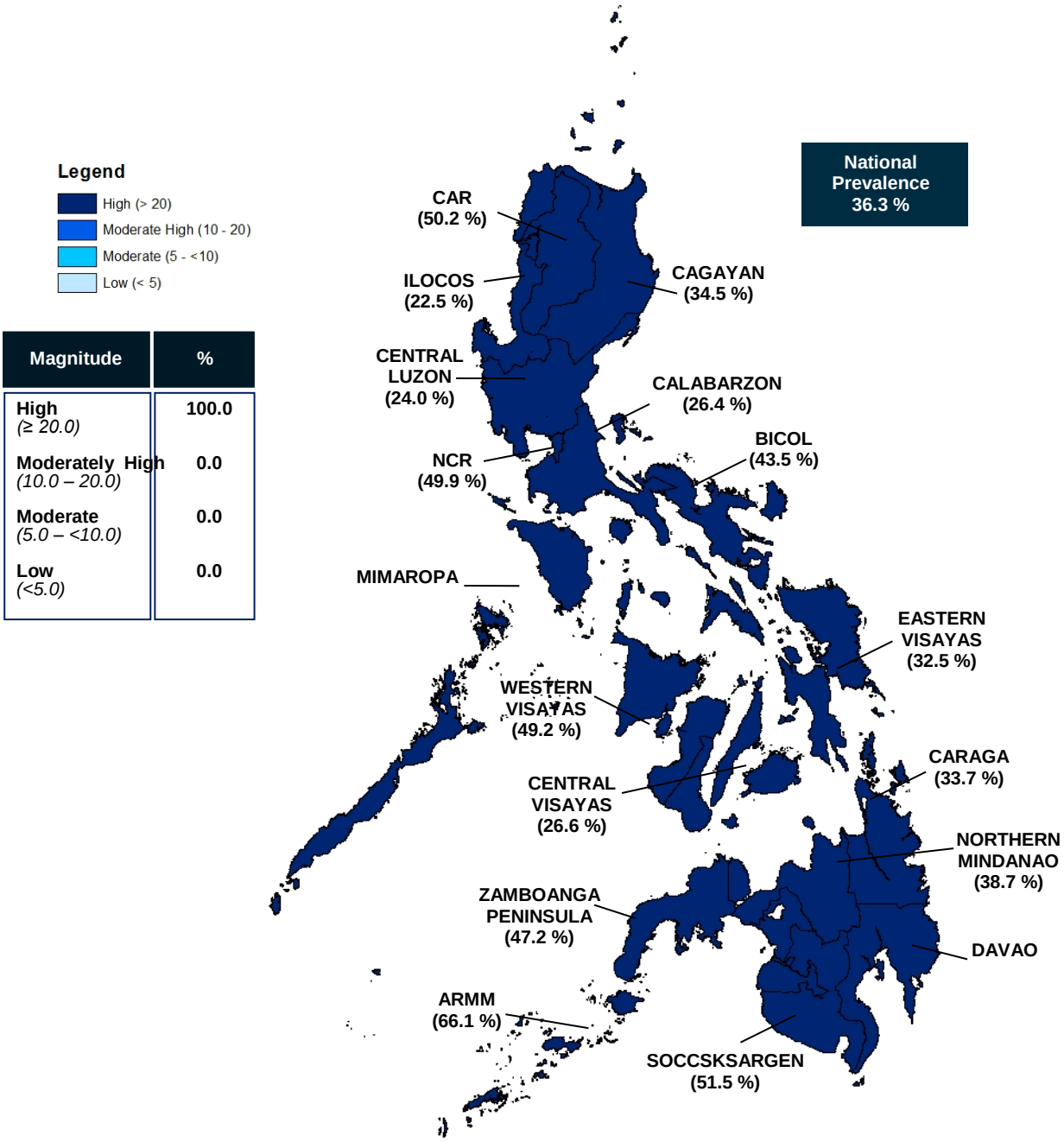
Magnitude	%
High *(≥ 20.0)*	64.7
Moderately High *(10.0 – 20.0)*	35.3
Moderate *(5.0 – <10.0)*	0.0
Low *(<5.0)*	0.0

Figure 45. Magnitude of zinc deficiency prevalence among the adolescents, 13 - 19 years by region: Philippines 2013



Magnitude	%
High *(≥ 20.0)*	70.6
Moderately High *(10.0 – 20.0)*	29.4
Moderate *(5.0 – <10.0)*	0.0
Low *(<5.0)*	0.0

Figure 46. Magnitude of zinc deficiency prevalence among the adults, 20 - 59 years by region: Philippines 2013



Magnitude	%
High *(≥ 20.0)*	100.0
Moderately High *(10.0 – 20.0)*	0.0
Moderate *(5.0 – <10.0)*	0.0
Low *(<5.0)*	0.0

Figure 47. Magnitude of zinc deficiency prevalence among the elderly, ≥ 60 years by region: Philippines 2013

3.6 Iodine Deficiency Disorders (IDD)

Urinary iodine excretion (UIE) level was determined as a measure of iodine status. Cut-off for interpretation of results is shown in Tables 16 and 17. Median UIE levels of the school children (168 µg/L) and adolescents (134 µg/L) and the proportion of UIE levels <50 µg/L was <20%, indicating that iodine nutrition for these groups is "optimal" (Tables 29 and 30). This indicated "sufficient" or "adequate" iodine intake for those groups. Among the adults, there could still be pockets of iodine deficiency even if the median UIE was >100 µg/L, since values of <50 µg/L was more than 20%. On the other hand, UIE levels among the elderly (80 µg/L) and lactating mothers (77µg/L) indicated "mild" iodine deficiency corresponding to insufficient iodine intake. IDD for these groups was a "mild" public health problem.

The cut-off for IDD among pregnant women is 150 µg/L. Thus, the median UIE of 105 µg/L and the proportion for the pregnant women with UIE < 50µg/L of 27%, indicates iodine deficiency.

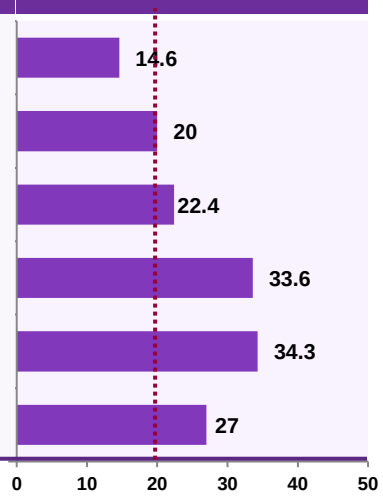
Median UIE levels indicating excessive iodine intake (≥ 300 µg/L) was highest among the school children at 23.2%. Among the pregnant women, median UIE levels indicating excessive iodine intake (≥ 500 µg/L) was present in 2.8%.

Table 29. Median and percent distribution of UIE levels by age and physiologic groups: Philippines, 2013

Age/ Physiologic Group	n	UIE ug/L						
		Median	<20	20 - 49	50 - 99	100- 199	200-299	≥300
Children, 6 – 12 y	22,588	168	7.7	8.7	14.9	26.6	18.9	23.2
Adolescents, 13 – 19 y	5,514	134	8.6	11.2	18.3	29.5	17.5	14.8
Adults, 20 – 59 y	14,820	116	9.4	13.0	21.4	31.1	15.2	9.9
Elderly, ≥ 60 y	3,676	80	15.0	18.7	24.0	27.6	8.9	5.8
Lactating women	1,460	77	15.6	18.6	24.8	26.0	10.3	4.7
		Median	**<20**	**20-49**	**50-149**	**150-249**	**250-499**	**≥500**
Pregnant women	1,095	105	11.1	15.9	37.4	20.7	12.1	2.8

Table 30. Median UIE and percent UIE values <50 µg/L by age and physiologic groups: Philippines, 2013

Age/ Physiologic State	n	Median	% Prevalence
Children, 6 – 12 y	22,588	168	14.6
Adolescents, 13 – 19 y	5,514	134	20
Adults, 20 – 59 y	14,820	116	22.4
Elderly, ≥ 60 y	3,676	80	33.6
Lactating women	1,460	77	34.3
Pregnant mothers	1,095	105	27



3.6.1 Prevalence of IDD by island group

The over-all median UIE among the school children 6-12 years old, was 168 µg/L with 16.4% having values <50 µg/L indicating "optimal" iodine status. By island groups, Luzon, Visayas and Mindanao had median UIE levels of 199 µg/L, 152 µg/dL and 115 µg/L, respectively (Table 31). The proportion of < 50 µg/dL of 12.5% for Luzon and 18.0% for Visayas indicates "optimal" iodine status corresponding to adequate iodine intake. Mindanao, had the lowest median UIE at 115 µg/mL with 24.9% having values <50 µg/L. This indicates the presence of IDD in Mindanao for this age group.

The over-all median UIE among the adolescents aged 13-19 years old, was 134 µg/L with 19.8% having values <50 µg/L indicating "optimal" iodine status. The proportion of <50 µg/L of 29.4% indicates IDD in Mindanao, even if a UIE median of 100 was obtained (Table 32). A higher median of 122 µg/L was obtained in the Visayas, but the proportion of <50 µg/L was borderline at 20.6%. Luzon had the highest median UIE of 158 µg/L and proportion of < 50 µg/L of 15.9% indicates "optimal" iodine status corresponding to sufficient iodine intake.

Table 31. Median and percent distribution of UIE level among schoolchildren, 6 -12 years by Island group: Philippines 2013

National / Island Group	Number	Median UIE ug/L	Frequency distribution, µg/L			
			< 20	20 – 49	50 – 99	≥ 100
Philippines	22,588	168	7.7	8.7	14.9	68.7
Luzon	11,711	199	5.9	6.6	12.5	75.1
Visayas	4,404	152	8.2	9.8	16.4	65.6
Mindanao	6,473	115	11.8	13.1	19.5	55.6

Severe <20; Moderate 20-49; Mild 50-99; Optimal ≥ 100
Values in red font indicate presence of IDD

Table 32. Median and percent distribution of UIE level among adolescents, 13 -19 years by island group: Philippines 2013

National / Island Group	Number	Median UIE ug/L	Frequency distribution, µg/L			
			< 20	20 – 49	50 – 99	≥ 100
Philippines	5,514	134	8.6	11.2	18.3	61.8
Luzon	2,826	158	7.1	8.8	16.9	67.2
Visayas	1,099	122	9.2	11.4	19.9	59.6
Mindanao	1,589	100	12.0	17.4	20.6	50.1

Severe <20; Moderate 20-49; Mild 50-99; Optimal ≥ 100
Values in red font indicate presence of IDD

The over-all median UIE among the adults aged 20-59 years old, was 116 µg/L with 22.4% having values <50 µg/L indicating presence of IDD in pockets of the population group (Table 33). By island groups, median UIE in Luzon had optimal iodine status, whereas median UIE of Visayas and Mindanao indicates the presence of IDD. In the Visayas, median UIE was 109 µg/L but 24% had median UIE <50 µg/L indicating IDD in pockets of the population. IDD in Mindanao was classified as "mild" since median was 87 µg/L and 30.9% had values <50 µg/L.

Table 33. Median and percent distribution of UIE level among adults, 20 -59 years by island group: Philippines 2013

National / Island Group	Number	Median UIE ug/L	Frequency distribution, µg/L			
			< 20	20 - 49	50 - 99	≥ 100
Philippines	14,820	116	9.4	13.0	21.4	56.2
Luzon	7,820	131	7.9	11.1	19.9	61.1
Visayas	2,788	109	9.7	14.3	22.7	53.3
Mindanao	4,212	87	13.5	17.4	24.5	44.6

Severe <20;Moderate 20-49; Mild 50-99; Optimal ≥ 100
Values in red font indicate presence of IDD

The over-all median UIE among the elderly aged 60 years and over, was 80 µg/L with 33.7% having values <50 µg/L indicating presence of "mild" IDD (Table 34). Median UIE and proportion of UIE <50 µg/L, for the three (3) island groups had indicated "mild" IDD corresponding to insufficient iodine intake.

The over-all median UIE of 84 µg/L, 74 µg/L and 66 µg/L for lactating mothers (Table 35) in Luzon, Visayas and Mindanao, respectively, all indicated the presence of IDD. The proportion of values <50 µg/L are all >20%, also indicative of iodine deficiency in the three islands.

The over-all median UIE of 125 µg/L, 91 µg/L and 75 µg/L for pregnant women (Table 36) from Luzon, Visayas and Mindanao, respectively, all indicate the presence of IDD. The proportion of values <50 µg/L are all >20%, also indicative of iodine deficiency.

Table 34. Median and percent distribution ofUIE level among the elderly, ≥ 60 years by island group: Philippines 2013

National / Island Group	Number	Median UIE ug/L	Frequency distribution, µg/L			
			< 20	20 - 49	50 – 99	≥ 100
Philippines	3,676	80	15.0	18.7	24.0	42.1
Luzon	1,976	85	13.7	18.6	23.3	44.3
Visayas	794	88	14.3	15.5	25.0	45.2
Mindanao	906	61	19.6	22.8	25.4	32.2

Severe <20; Moderate 20-49; Mild 50-99; Optimal ≥ 100
Values in red font indicate presence of IDD

Table 35. Median and percent distribution of UIE level among lactating mothers, by Island group: Philippines 2013

National / Island Group	Number	Median UIE ug/L	Frequency distribution, µg/L			
			< 20	20 - 49	50 - 99	≥ 100
Philippines	1,460	77	15.6	18.6	24.8	41.0
Luzon	724	84	14.7	17.8	23.3	44.2
Visayas	303	74	16.4	16.6	27.4	39.6
Mindanao	433	66	17.2	22.4	25.8	34.6

Severe <20; Moderate 20-49; Mild 50-99; Optimal ≥ 100
Values in red font indicate presence of IDD

Table 36. Median and percent distribution of UIE level among pregnant women by Island group: Philippines 2013

National / Island Group	Number	Median UIE ug/L	Frequency distribution, µg/L			
			< 20	20 - 49	50 - 149	≥ 150
Philippines	1,095	105	11.1	15.9	37.4	35.6
Luzon	579	125	10.4	13.2	35.5	40.9
Visayas	198	91	11.1	17.3	42.8	28.9
Mindanao	318	75	13.1	21.8	38.0	27.0

Insufficient< 150; Adequate ≥ 150
Values in red font indicate presence of IDD

3.6.2 Prevalence of IDD by place of residence

Table 37 shows the median UIE and proportion of values < 50 µg/L by place of residence. Except for the school children aged 6-12 years, where those residing in the rural areas have higher median UIE values compard to those in the urban areas, all the other age/physiologic groups residing in the urban areas have generally higher median UIE values. Among the children, although the median UIE are both > 100 µg/L, there still existed pockets of deficiency in the urban areas since those with < 50 µg/dL is > 20%. Pockets of deficiency among the adolescents residing in the rural areas were also observed. Among the elderly, pregnant women and lactating mothers, there exist IDD in those residing in both the urban and rural areas.

Table 37. Median UIE levels and percent <50 µg/L by place of residence: Philippines 2013

Age (y) Physiologic Group	Median UIE (% <50 µg/L)		
	Philippines	Rural	Urban
Children, 6-12[1]	168 (16.4)	141 (20.5)	199 (11.6)
Adolescents, 13-19[1]	134 (19.8)	112 (24.4)	165 (15.3)
Adults, 20 – 59[1]	116 (22.4)	100 (26.0)	134 (19.4)
Elderly, ≥ 60[1]	80 (33.7)	76 (35.3)	87 (32.1)
Lactating[1]	77 (34.3)	72 (36.5)	85 (31.7)
Pregnant[2]	105 (27.0)	90 (32.7)	122 (21.3)

[1]Severe <20; Moderate 20-49; Mild 50-99; Optimal ≥ 100
[2]Insufficient < 150; Adequate ≥ 150
Values in red font indicate presence of IDD

3.6.6 Prevalence of IDD by wealth quintile

Median UIE and proportion < 50 µg/L by wealth quintile is shown in Table 38. A trend of lowest median UIE among the poorest, increasing to the highest percentage among the richest quintile was observed for the children, adolescents, adults and the elderly. Among the lactating mothers median UIE was lowest among the poorest quintile and highest among the richest quintile, but there was no trend from the poorest to the richest. Among the pregnant women, lowest median UIE was recorded among the middle quintile and highest among the richest quintile.

Table 38. Median UIE levels and percent <50 µg/L by wealth quintile: Philippines 2013

Age,y Physiologic Group	Median UIE (% <50 µg/L)				
	Poorest	Poor	Middle	Rich	Richest
Children, 6-12[1]	119 (24.2)	152 (18.0)	190 (13.9)	205 (11.3)	230 (8.7)
Adolescents,13-19[1]	99 (28.1)	120 (22.3)	143 (18.8)	163 (15.3)	188 (12.9)
Adults, 20 – 59[1]	92 (29.4)	101 (26.1)	113 (22.2)	132 (18.9)	147 (16.8)
Elderly, ≥ 60[1]	67 (37.9)	73 (37.3)	78 (34.9)	85 (33.2)	104 (25.9)
Lactating[1]	66 (37.9)	70 (37.3)	86 (29.6)	78 (32.7)	100 (28.3)
Pregnant[2]	96 (27.0)	107 (26.7)	85 (34.8)	122 (23.3)	136 (22.2)

[1]Severe <20; Moderate 20-49; Mild 50-99; Optimal ≥ 100
[2] Insufficient< 150; Adequate ≥ 150
Values in red font indicate presence of IDD

3.6.4 Prevalence of IDD by region

School Children (6-12 yrs): Over-all median UIE for the school children was 168 µg/L classified as "optimal" iodine status (Figure 48). One (1) region (Zamboanga Peninsula) or 5.9 % of the regions had mild IDD. Iodine status was optimal in 94.1% of the regions. However, pockets of deficiency still exist in four (4) of the regions (Western Visayas, Northern Mindanao, ARMM and Davao), since the proportion of median UIE <50 µg/L was >20%, even if their medians are >100 µg/L (Appendix 16 to18).

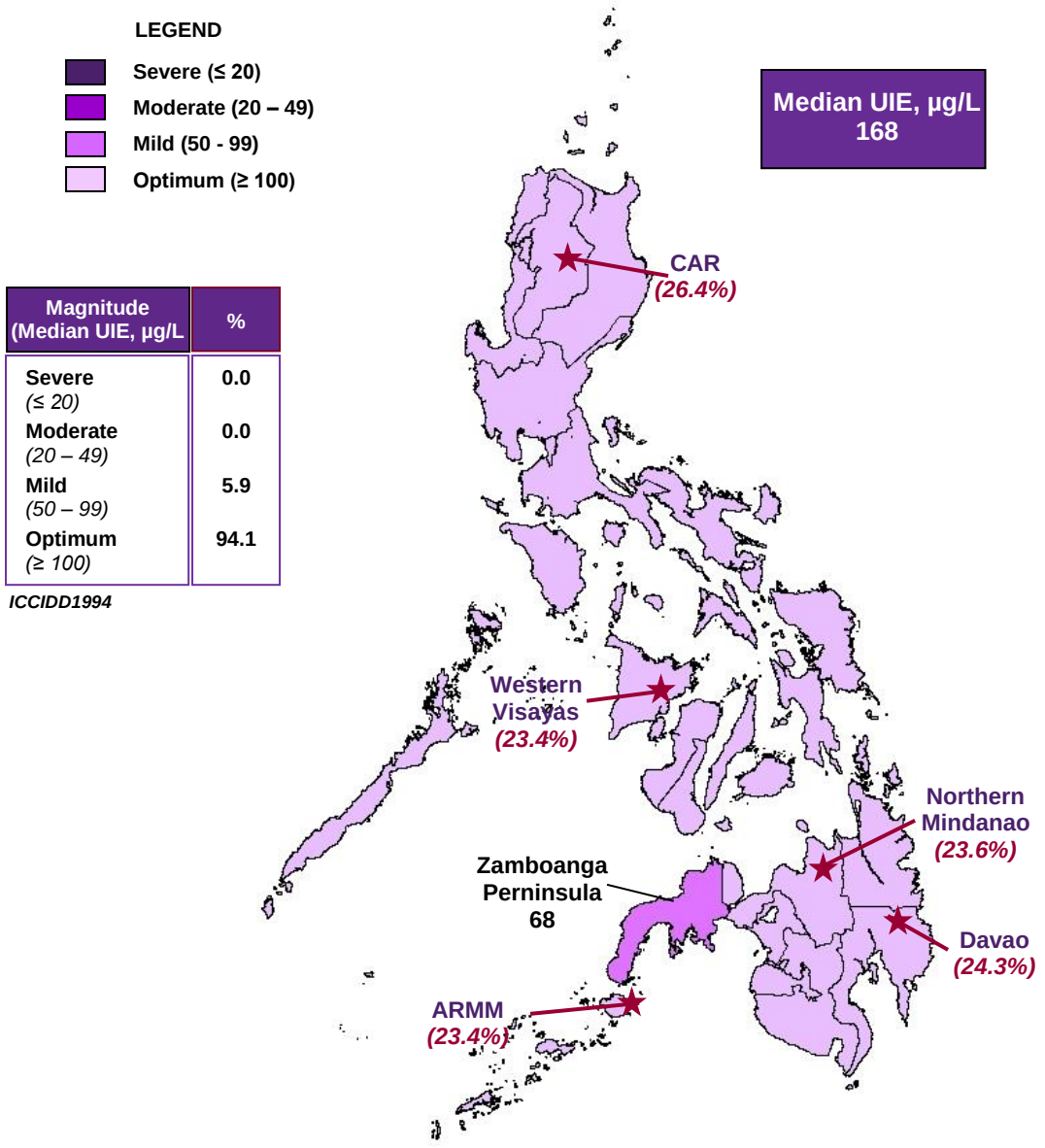
Adolescents (13-19 yrs): Over-all median UIE for the adolescents was 134 µg/L classified as "optimal" iodine status (Figure 49). Three of the regions (Zamboanga Peninsula, SOCCSARGEN and Davao) or 17.6% had "mild" IDD. However, pockets of deficiency still exist in eight (8) regions (Ilocos, Cagayan Valley, Central Visayas, Western Visayas, ARMM and Northern Mindanao, CAR and CARAGA), since the proportion of median UIE < 50 µg/L was > 20% (Appendix 19).

Adults (20-59 yrs): Over-all median UIE for the adults was 116 µg/L classified as "optimal" iodine status (Figure 50). Six (6) of the regions (Zamboanga Peninsula, Northern Mindanao, Davao, SOCCSARGEN, CAR and ARMM) or 35.3% had "mild" IDD. However, pockets of deficiency still exist in eight (8) regions (NCR, Ilocos, Cagayan Valley, Central Luzon, MIMAROPA, Bicol, Western Visayas, Central Visayas, and CARAGA), since the proportion of median UIE <50 µg/L was >20% (Appendix 20).

Elderly (60 years over): Over-all median UIE for the elderly was 80 µg/L classified as "mild" IDD (Figure 51). Only two (2) of the regions (CALABARZON and Eastern Visayas) had median UIE classified as "optimal" iodine status; but CALABARZON still had pockets of deficiency since proportion of <50 µg/l was >20%. One (1) of the regions (Zamboanga Peninsula) had "Moderate" IDD and the rest of the regions had mild IDD (Appendix 21).

Lactating Mothers: Over-all median UIE for the lactating mothers was 77 µg/L classified as "mild" IDD (Figure 52). One (1) of the regions (Zamboanga Peninsula) had median UIE classified as "moderate" IDD and the rest of the regions had "mild" IDD (Appendix 22).

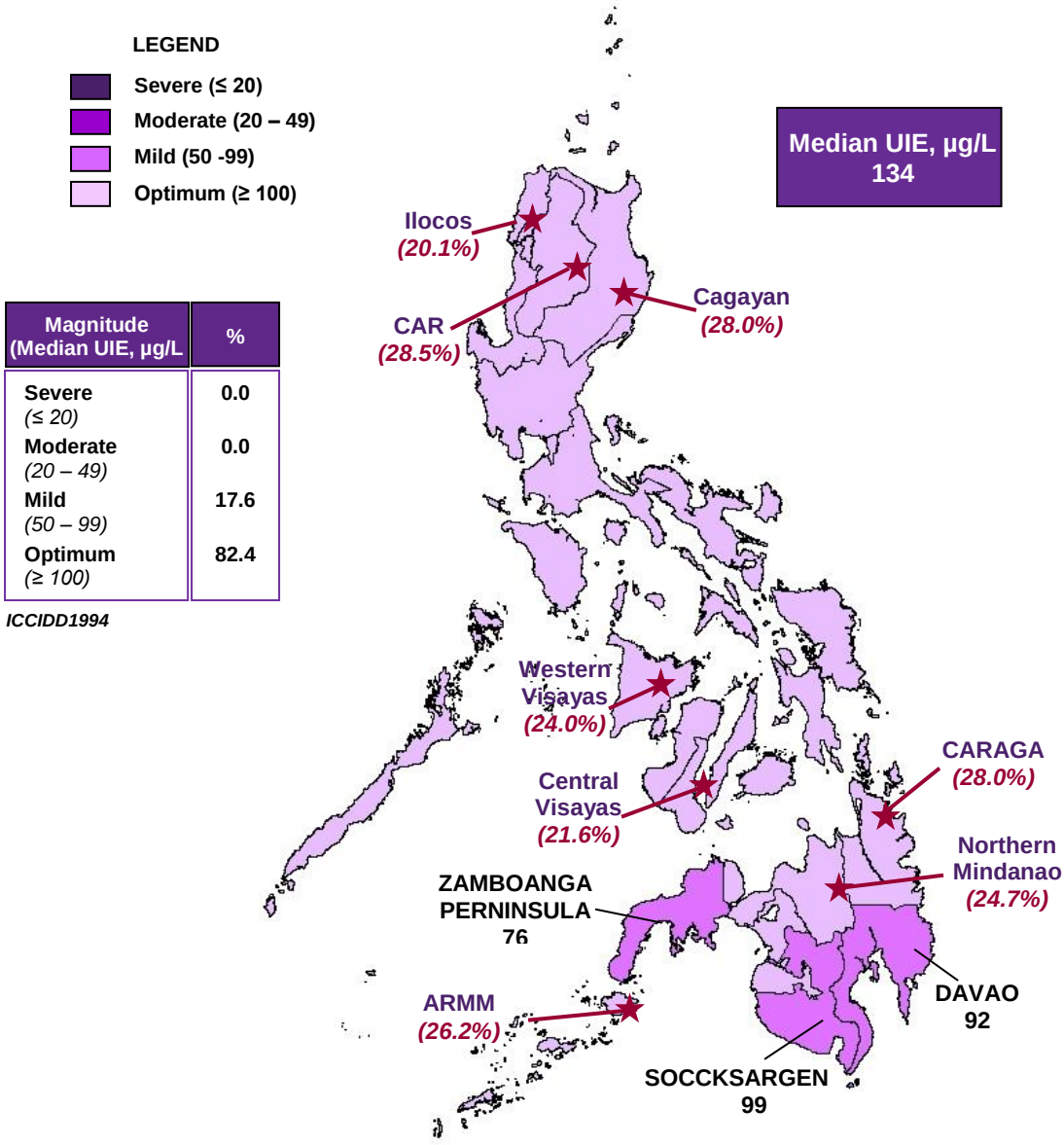
Pregnant Women: Over-all median UIE for the pregnant was 105 µg/L classified as "insufficient" iodine status indicating the presence of IDD (Figure 53). Sixteen (16) or 94.1 % of the regions had IDD. Only NCR had sufficient iodine status with 157 µg/L UIE concentration (Appendix 23).



Magnitude (Median UIE, µg/L	%
Severe (≤ 20)	0.0
Moderate (20 – 49)	0.0
Mild (50 – 99)	5.9
Optimum (≥ 100)	94.1

ICCIDD1994

Figure 48. Median and prevalence of UIE <50 µg/L among schoolchildren, 6 - 12 years by region: Philippines 2013



Magnitude (Median UIE, µg/L	%
Severe *(≤ 20)*	0.0
Moderate *(20 – 49)*	0.0
Mild *(50 – 99)*	17.6
Optimum *(≥ 100)*	82.4

Figure 49. Median and prevalence of UIE <50 µg/L among adolescents, 13 - 19 years by region: Philippines 2013

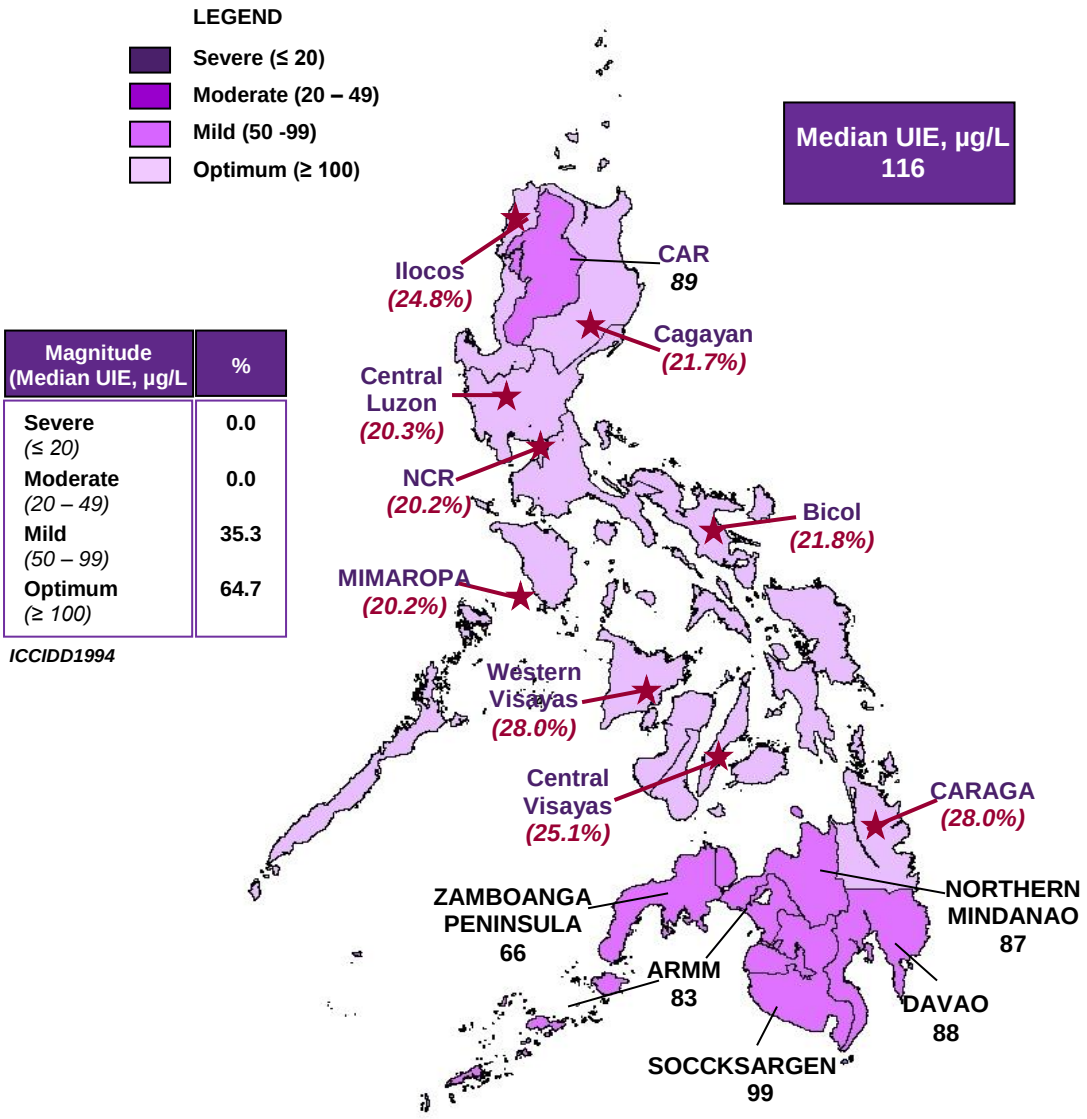


Figure 50. Median and prevalence of UIE <50 µg/L among adults, 20 - 59 years by region: Philippines 2013

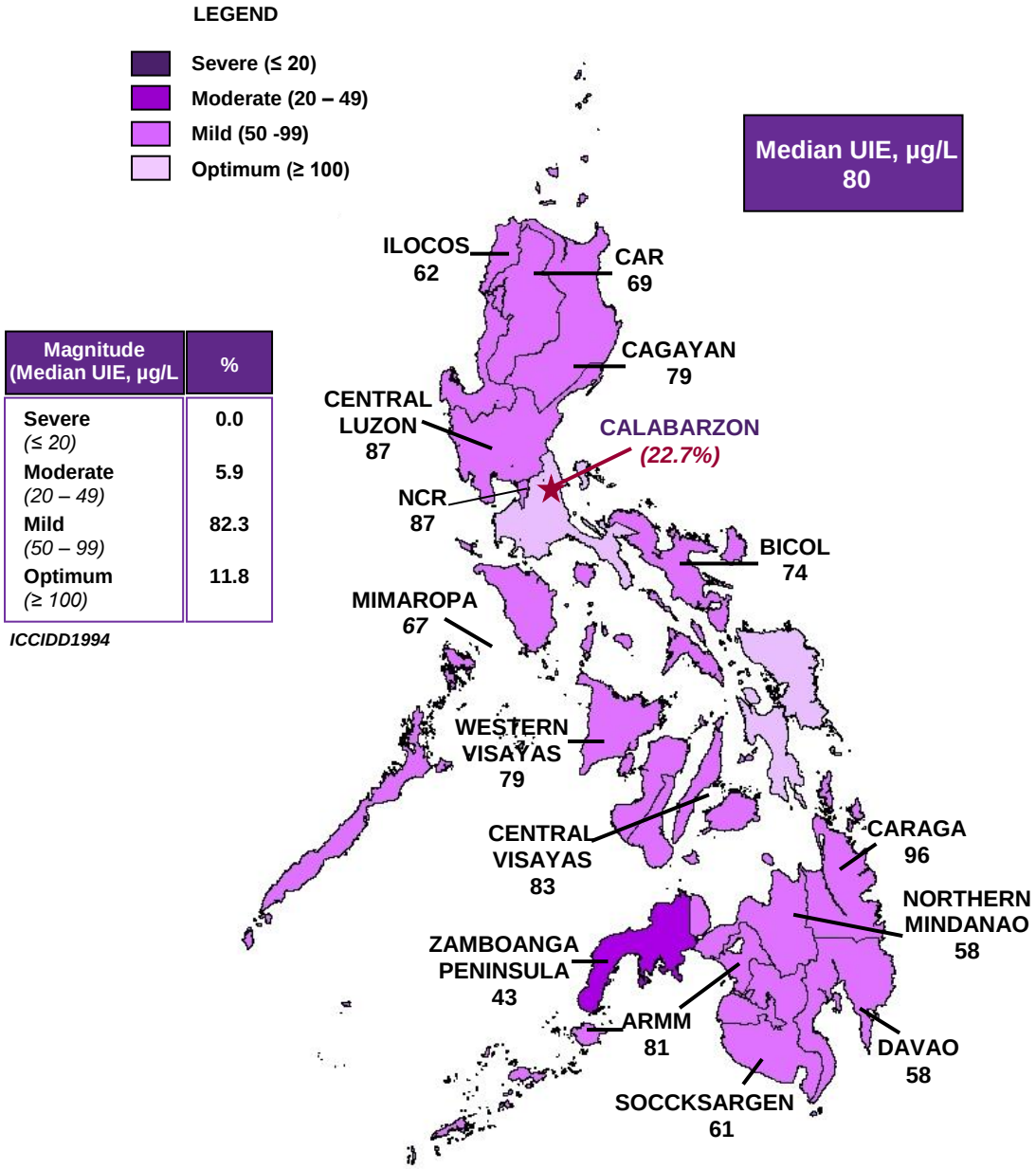


Figure 51. Median and prevalence of UIE <50 µg/L among the elderly, ≥ 60 years by region: Philippines 2013

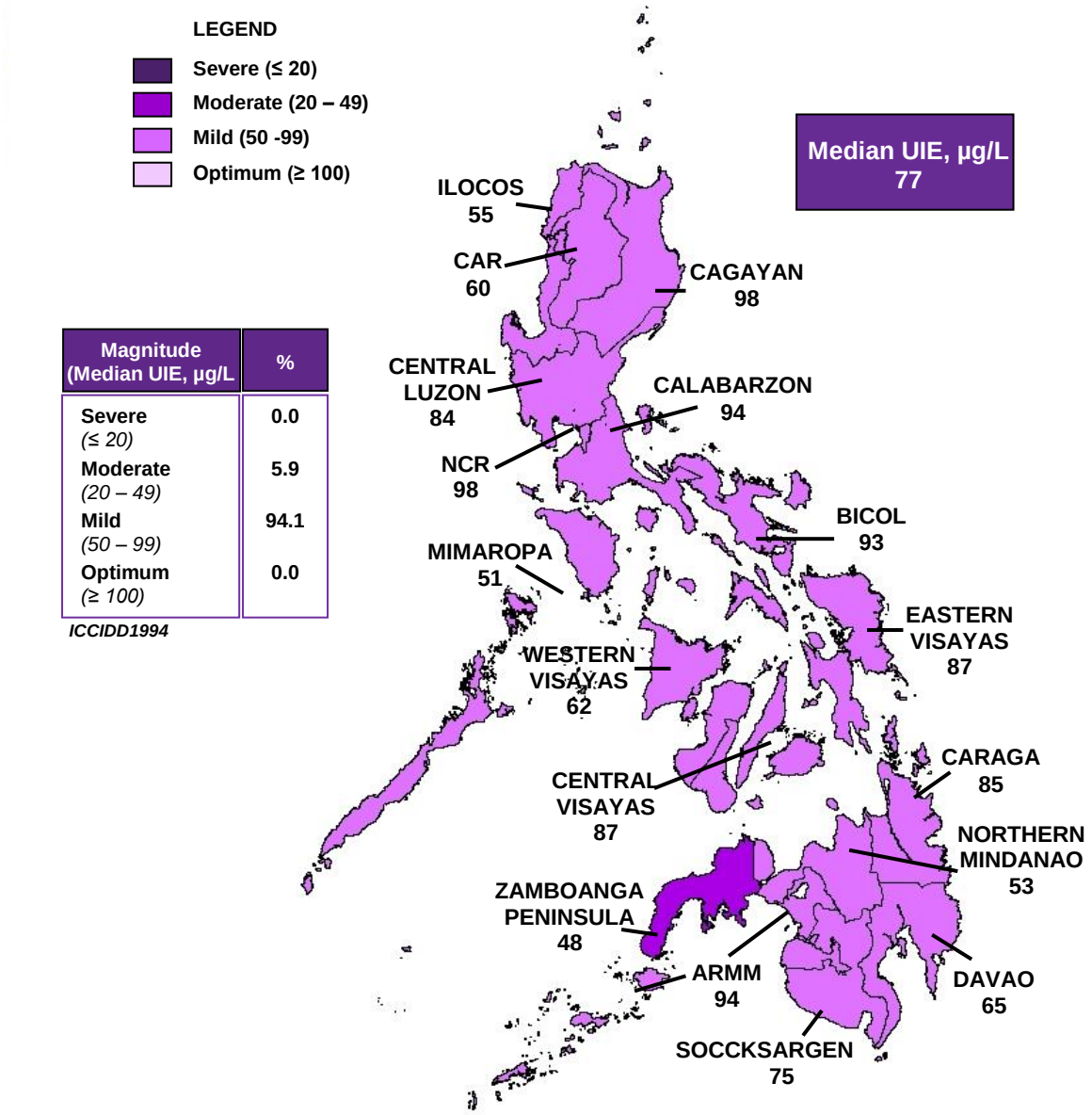


Figure 52. Median and prevalence of UIE <50 µg/L among lactating mothers by region: Philippines 2013

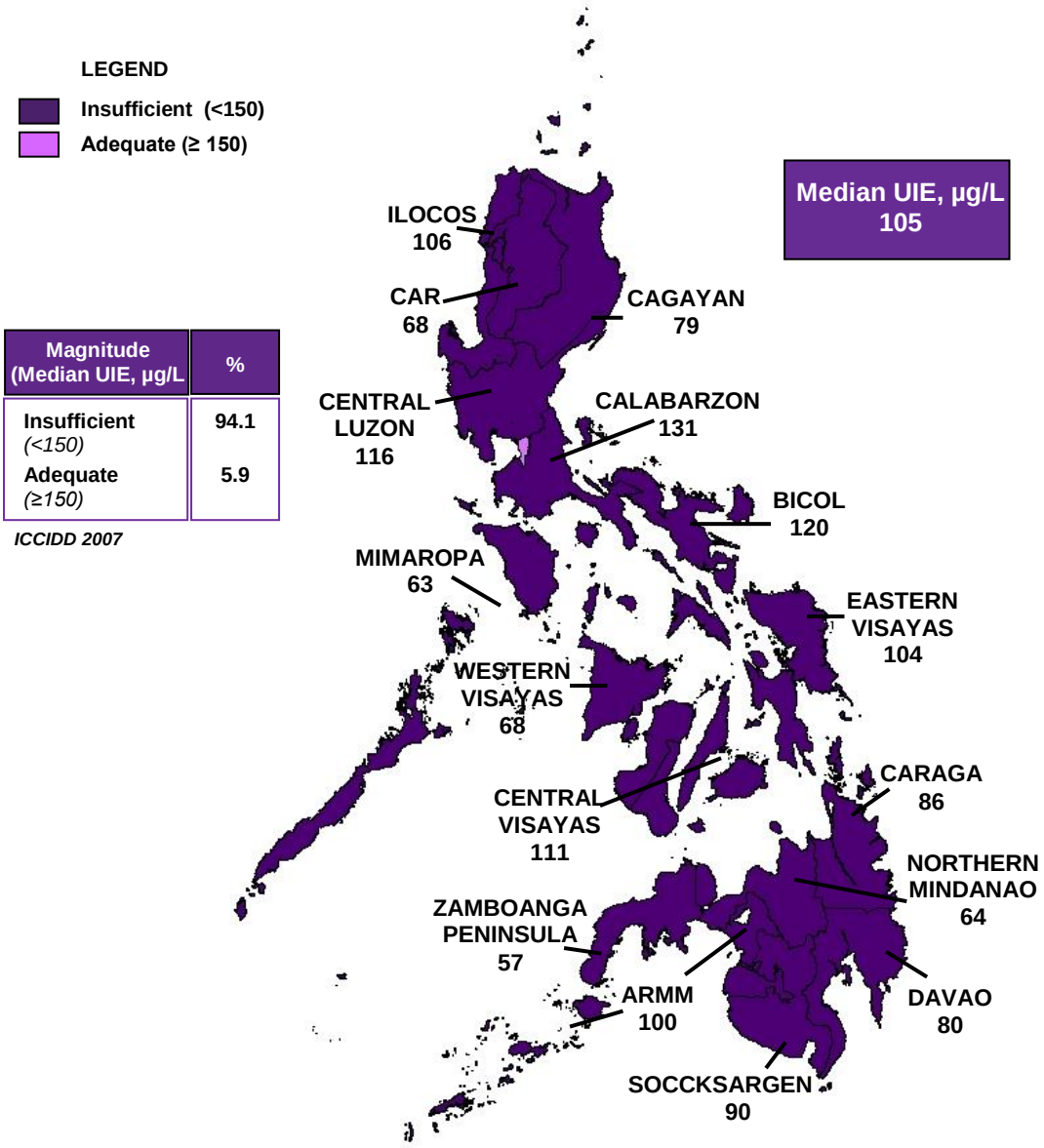


Figure 53. Median and prevalence of UIE <50 µg/L among pregnant women by region: Philippines 2013

3.7.5 Prevalence of IDD by province among the school children

None of the provinces had UIE levels that were considered "severe". Thirteen (13) or 15.5% had median levels corresponding to the presence of IDD (moderate and mild) (Table 39). Fourteen (14) or 20.2% had median UIE level corresponding to more than adequate iodine status. Of the provinces, highest levels were recorded in Cavite, Quirino and Bulacan while lowest were recorded in Zamboanga del Norte, Guimaras and Quirino (Appendix 11-13).

Table 39. Number and proportion of provinces according to iodine status among the school children

Median UIE, µg/L	Iodine Status*	No.	%
< 20	Severe iodine deficiency	0	0
20 - 49	Moderate iodine deficiency	2	2.4
50 - 99	Mild iodine deficiency	11	13.1
100 - 199	Optimal	54	64.3
200 - 299	Risk of induced hyperthyroidism in susceptible groups	14	20.2
≥ 300	Risks of adverse health consequences	0	0

**WHO, UNICEF and ICCIDD, 2001*

3.7.6 Trends in the prevalence of IDD in the Philippines:

School children 6-12 years old:

Among the school children 6-12 years old, UIE was 168 µg/L in 2013 (Figure 43). This was higher than the median of 132 µg/L obtained in 2008 but lower than the 201 µg/L obtained in 2003. In the 2003 NNS, there was a significant increase in the median UIE to 201 µg/L from the 1998 median of 77 µg/L. Levels < 50 µg/L were 11.4% and 19.7% in 2003 and 2008, respectively. The 2003, 2008 and 2013 levels corresponded to optimum iodine nutrition.

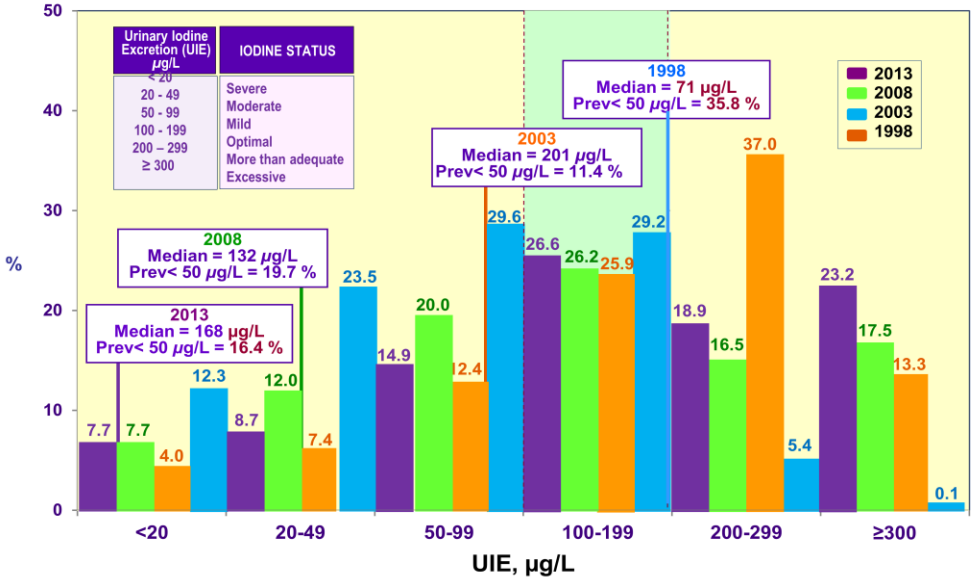


Figure 54. Frequency distribution of UIE values among school children, 6-12 years: Philippines, 1998, 2003, 2008 and 2013

Lactating mothers:

Among the lactating mothers, median UIE was 111 µg/L in 2003 but decreased to 81 µg/L in 2008 which further decreased to 77 µg/L in 2013 (Figure 44). Both the 2008 and 2013 levels were indicative of insufficient iodine status corresponding to IDD. UIE values < 50 µg/L were 23.7%, 34.0% and 34.2% for 2003, 2008 and 2013 NNS, respectively, also indicate the presence of IDD.

UIE values corresponding to insufficient (<100 µg/L) iodine intake among the lactating mothers were 46.4%, 59.5% and 59% for the 2003, 2008 and 2013 NNS series, respectively. Adequate values (100-199 µg/L) were 29.1% in 2003, decreasing to 25.7% in 2008 and 26.0% in 2013. Above requirements (200-299 µg/L) were 21.1% in 2003, 8.9% in 2008 and 10.3 % in 2013. Excessive values (≥ 300 µg/L) excessive values were also found; 3.6 % in 2003, 5.8 % in 2008 and 4.7% in 2013 NNS.

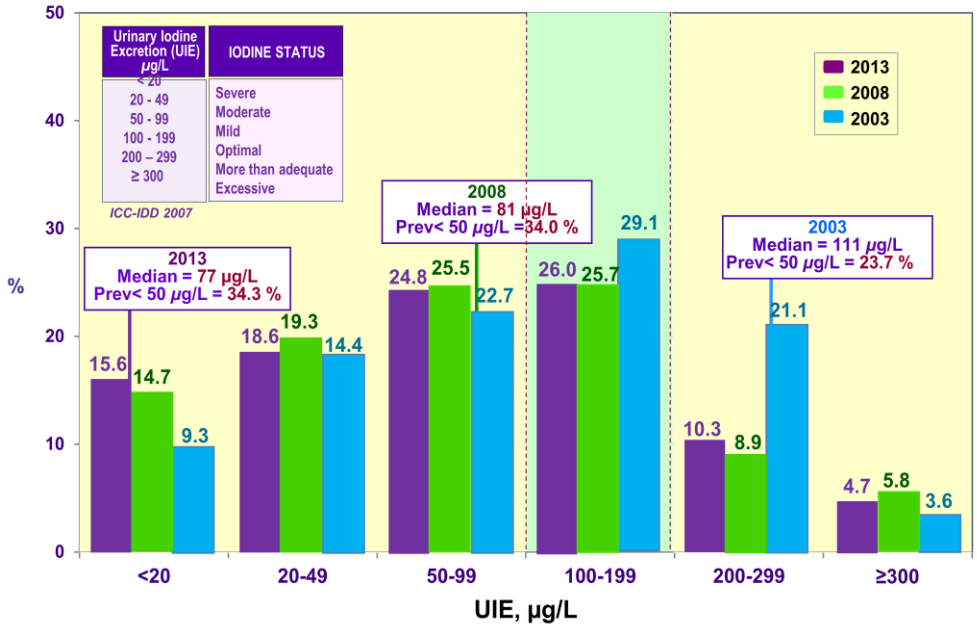


Figure 55. Frequency distribution of UIE values among lactating mothers: Philippines, 2003, 2008 and 2013

Pregnant women:

Among the pregnant women, median UIE of 105 µg/L was obtained in 2013 (Figure 45). Median UIE was 142 µg/L in 2003 but decreased to 105 µg/L in 2008. Both values corresponded to "insufficient" levels (<150 µg/L) for pregnant women. UIE values <50 µg/L were 18.0% and 25.8% for 2003 and 2008, respectively). The 2013 UIE level of 105 µg/L is also indicative of IDD.

UIE values (<150 µg/L) corresponding to insufficient iodine intake among the pregnant women levels were 52.0% and 67.3% for the 2003 and 2008 NNS series, respectively. Adequate values (150-249 µg/L) were 25.4% in 2003, decreasing to 18.1% in 2008. Above requirements (250-499 µg/L) were 22.5% in 2003 and 13.5% in 2008, respectively. There were no excessive values (500 µg/L) in 2003, but excessive values were found in 2008 and 2013 NNS with 1.3% and 2.8% respectively.

Elderly 60 years and over:

Among the elderly, IDD was only determined in the 2008 and 2013 NNS. In 2013, median UIE is 80 µg/L. This is lower than the median of 107 µg/L obtained in 2008 (Figure 46). The values of < 50 µg/L, for both surveys were all above 20% indicating the presence of IDD among the elderly. "Adequate" values were 31.4% in 2008 but decreased to 27.6% in 2013. "Excessive" values were 8.8% and 5.8% in the 2008 and 2013 NNS, respectively

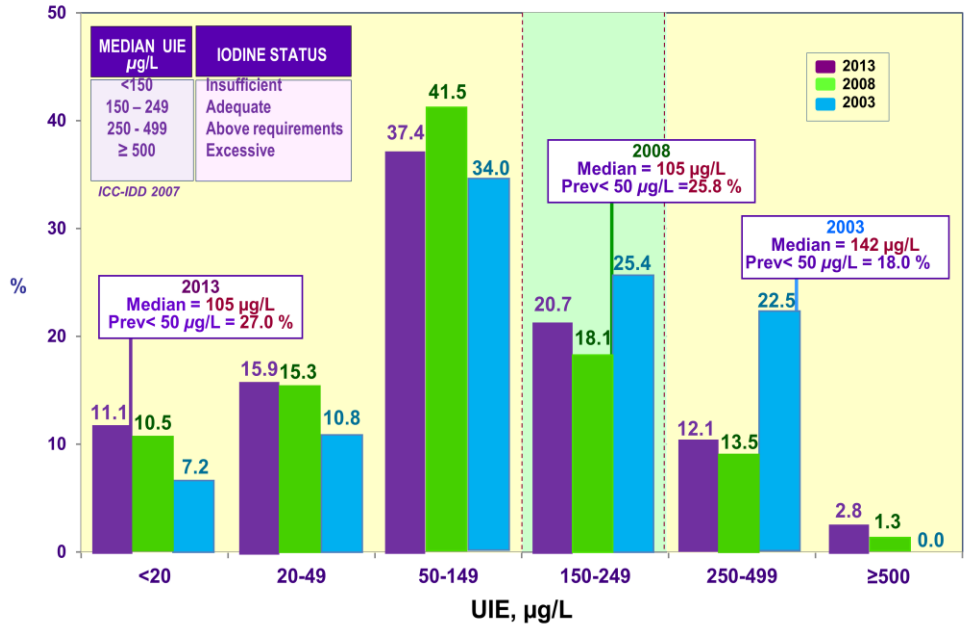


Figure 56. Frequency distribution of UIE values among pregnant women: Philippines 2003, 2008 and 2013

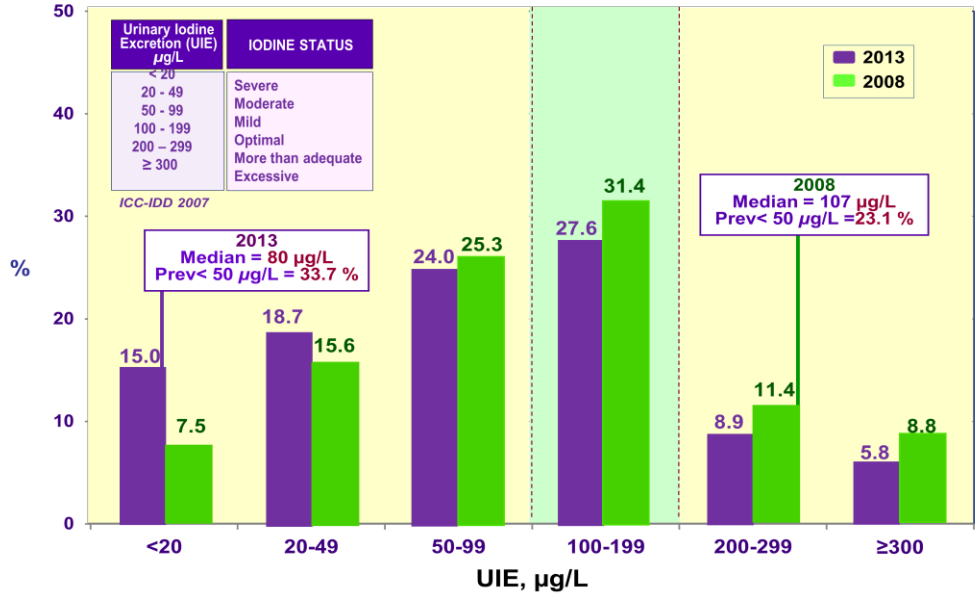


Figure 57. Frequency distribution of UIE values among the elderly: Philippines, 2008 and 2013

4. CONCLUSION

The Biochemical component of the 2013 NNS included determinations of anemia, VAD, zinc deficiency and IDD. Determination of thalassemia, iron deficiency anemia and vitamin D deficiency are included for the first time in the NNS.

Over-all anemia prevalence in the Philippines has declined from "moderate" at 28.9% in 1993 to "mild" at 11.1% in 2013. It was highest among the infants aged 6 months to less than one (1) year old at 40.1% which is considered a "severe" public health problem. Among the pregnant women (24.6%) and lactating mothers (16.7%), anemia prevalence was still moderate and mild public health problem, respectively. Anemia prevalence was higher among the elderly (22.6%) and lactating women (20.0%) in the rural areas. On the other hand, anemia prevalence among pregnant women was higher among those in the urban areas (29.0%). Anemia prevalence was highest among the poorest infants 6 months to 5 years (16.5%), adults (10.9%) and the elderly (24.0%). Among the pregnant women, anemia was highest among the rich (32.0%).

Thalassemia was determined among household members 6 yrs and over and pregnant women only in the NCR. Of the anemic household members, 17.2% had some form of hemoglobin disorder. The most frequent disorder was α-thalassemia at 13.9% while β-thalassemia was found in 1.6%.

In the NCR, iron deficiency anemia (IDA) was found in 57.5% of adolescents (13-19 years) and 54.6% of the adults (20 years and over). Among the pregnant women, IDA was present in 78.7%.

Over-all VAD prevalence is 6.1%. Among the preschool children, 6 mos to 5 years, VAD is still a "severe" pubic health problem at 20.4%. The younger infants aged 6 months to < 1 year, have higher VAD prevalence at 27.9%, compared to the older infants aged 1 to 5 years at 19.6%. Among the pregnant women and lactating mothers, VAD was 9.0% and 6.4%, respectively. VAD prevalence rate was considered "mild" for both the pregnant and lactating women.

Over-all, mean vitamin D levels were highest among the adults from Cagayan (107±3.6 nmol/mL) and lowest was for the adults from Benguet (73.3±1.3 nmol/mL). Males had higher vitamin D levels compared to their female counterparts. The highest proportions of deficient and insufficient levels were found among the adults from Benguet (60.3%) and the lowest were among the adults from Cagayan (19.5%). There were more deficient and insufficient levels among the females compared to the males.

Over-all prevalence of zinc deficiency is 25.6%, which is considered a "high" public health concern. Highest prevalence of deficiency was observed among the elderly, aged 60 years and above at 36.3% and lowest prevalence was recorded among the pregnant women at 13.7%. Prevalence of deficiency among the elderly, adults, and lactating women, as well as that of the school children and adolescents is considered a "high" public health concern, while that of the pregnant women and pre-school children, prevalence was "moderately high".

Iodine status of school children, aged 6 – 12 years old, is now optimal (Median UIE=168 µg/L, % <50 µg/L=16.4%) although pockets of deficiency still exists. IDD was still seen among the elderly (Median UIE=80 µg/L, % <50µg/L=23.7%), pregnant (Median UIE=105 µg/L) and lactating (Median UIE=77 µg/dL, % <50 µg/L=27.0%) women.

The 2013 NNS shows that there is improvement in the micronutrient status of Filipinos. Results of the 2013 NNS show a trend towards lower anemia and VAD prevalence among Filipinos. Zinc deficiency is a "high" public health concern among Filipinos. Iodine nutrition among school children corresponded to adequate iodine intakes. However, prevalence rates on certain vulnerable groups such as the infants 6 months to less than 1year, pregnant women, lactating mothers and the elderly remains high.

The survey on thalassemia and vitamin D deficiency in selected areas has revelaed that these are problems too. Thalassemia could be a contributing factor to the anemia problem. Programs on their alleviation should thus be initiated.

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6. APPENDICES

Appendix 1. Prevalence of anemia among preschool children, 6 months – 5 years old, by region: Philippines, 2013

Region		N	Prevalence (%)	SE	95% C.I.		CV
					LL	UL	
PHILIPPINES		**3190**	**13.8**	**0.73**	**12.5**	**15.3**	**5.3**
	NCR	228	10.0	2.56	5.93	16.23	25.8
	CAR	155	10.7	2.60	6.53	16.93	24.4
I.	Ilocos	203	8.9	2.08	5.61	13.96	23.3
II.	Cagayan Valley	178	24.1	2.93	18.83	30.32	12.2
III.	Central Luzon	307	14.7	2.08	11.10	19.32	14.1
IV-A.	CALABARZON	331	14.3	2.07	10.69	18.85	14.5
IV-B.	MIMAROPA	124	20.8	3.60	14.64	28.78	17.3
V.	Bicol	117	15.8	3.51	10.09	23.99	22.2
VI.	Western Visayas	197	12.4	2.79	7.90	19.02	22.5
VII.	Central Visayas	227	18.7	3.28	13.05	25.96	17.6
VIII.	Eastern Visayas	123	11.3	2.44	7.29	17.03	21.7
IX.	Zamboanga Peninsula	160	5.0	1.74	2.51	9.77	34.7
X.	Northern Mindanao	204	8.0	2.12	4.74	13.32	26.4
XI.	Davao	199	13.4	2.18	9.70	18.31	16.2
XII.	SOCCSKSARGEN	221	20.3	3.12	14.88	27.16	15.4
	ARMM	121	21.9	4.36	14.54	31.64	19.9
	CARAGA	95	9.4	3.85	4.06	20.09	41.1

Appendix 2. Prevalence of anemia among school children, 6 – 12 years old by region: Philippines, 2013

Region		N	Prevalence (%)	SE	95% C.I.		CV
					LL	UL	
PHILIPPINES		**5,794**	**11.1**	**0.57**	**10.0**	**12.3**	**5.2**
	NCR	438	7.1	1.57	4.6	10.9	22.1
	CAR	269	5.8	1.25	3.7	8.8	21.7
I.	Ilocos	331	9.4	2.01	6.2	14.2	21.3
II.	Cagayan Valley	261	19.9	2.40	15.6	25.0	12.1
III.	Central Luzon	482	13.8	2.06	10.3	18.4	14.9
IV-A.	CALABARZON	544	11.3	1.99	7.9	15.8	17.6
IV-B.	MIMAROPA	287	21.5	4.00	14.8	30.4	18.5
V.	Bicol	296	10.3	2.10	6.9	15.2	20.3
VI.	Western Visayas	378	10.3	1.72	7.3	14.3	16.8
VII.	Central Visayas	365	14.4	1.96	11.0	18.7	13.6
VIII.	Eastern Visayas	323	9.9	1.78	6.9	14.9	18.3
IX.	Zamboanga Peninsula	282	4.2	1.44	2.1	8.2	34.1
X.	Northern Mindanao	317	5.9	1.09	4.1	8.5	18.4
XI.	Davao	358	12.3	2.57	8.0	18.3	21.0
XII.	SOCCSKSARGEN	359	9.7	1.85	6.6	13.9	19.1
	ARMM	264	18.1	3.95	11.6	27.2	21.8
	CARAGA	240	10.0	1.51	7.4	13.4	15.1

Appendix 3. Prevalence of anemia among adolescents, 13 – 19 years old by region: Philippines, 2013

Region		N	Prevalence (%)	SE	95% C.I.		CV
					LL	UL	
PHILIPPINES		**5,500**	**7.7**	**0.47**	**6.9**	**8.7**	**6.1**
	NCR	448	6.3	1.51	3.9	10.0	24.0
	CAR	205	3.8	1.01	2.3	6.4	26.4
I.	Ilocos	338	4.7	1.20	2.8	7.7	25.7
II.	Cagayan Valley	288	15.7	1.72	12.6	19.4	11.0
III.	Central Luzon	457	9.6	1.71	6.7	13.5	17.9
IV-A.	CALABARZON	477	9.8	1.85	6.7	14.1	18.9
IV-B.	MIMAROPA	260	11.9	2.73	7.5	18.4	23.0
V.	Bicol	307	4.2	1.22	2.3	7.3	29.1
VI.	Western Visayas	396	8.3	1.56	5.7	11.9	18.8
VII.	Central Visayas	393	8.5	1.63	5.8	12.3	19.3
VIII.	Eastern Visayas	313	4.1	1.13	2.4	7.0	27.4
IX.	Zamboanga Peninsula	264	7.5	2.03	4.4	12.6	27.0
X.	Northern Mindanao	289	5.6	1.42	3.4	9.2	25.2
XI.	Davao	329	6.8	1.22	4.7	9.6	18.1
XII.	SOCCSKSARGEN	330	5.6	1.17	3.7	8.4	21.0
	ARMM	218	10.9	2.21	7.3	16.0	20.2
	CARAGA	188	7.5	2.23	4.2	13.2	29.7

Appendix 4. Prevalence of anemia among adults, 20 – 59 years old by region: Philippines, 2013

Region		N	Prevalence (%)	SE	95% C.I.		CV
					LL	UL	
PHILIPPINES		**14,665**	**9.3**	**0.34**	**8.7**	**10.0**	**3.6**
	NCR	1,264	8.8	1.05	6.9	11.1	11.9
	CAR	603	5.2	1.29	3.2	8.4	25.0
I.	**Ilocos**	923	7.8	1.02	6.0	10.1	13.1
II.	**Cagayan Valley**	777	13.4	1.92	10.0	17.6	14.3
III.	**Central Luzon**	1,371	11.2	1.26	9.0	13.9	11.2
IV-A.	**CALABARZON**	1,471	9.2	0.79	7.8	10.9	8.6
IV-B.	**MIMAROPA**	585	12.4	1.71	9.4	16.2	13.8
V.	**Bicol**	683	8.0	1.43	5.6	11.3	18.0
VI.	**Western Visayas**	991	7.6	1.06	5.8	10.0	13.8
VII.	**Central Visayas**	1,059	12.1	1.34	9.7	14.9	11.1
VIII.	**Eastern Visayas**	715	6.5	0.96	4.8	8.6	14.8
IX.	**Zamboanga Peninsula**	640	7.7	1.57	5.1	11.4	20.4
X.	**Northern Mindanao**	786	8.2	1.40	5.8	11.4	17.2
XI.	**Davao**	901	8.1	1.06	6.3	10.5	13.1
XII.	**SOCCSKSARGEN**	875	9.5	1.22	7.4	12.2	12.8
	ARMM	461	11.9	2.94	7.2	18.9	24.7
	CARAGA	560	9.0	1.50	6.0	12.4	16.6

Appendix 5. Prevalence of anemia among the elderly, ≥ 60 years old by region: Philippines, 2013

Region		N	Prevalence (%)	SE	95% C.I.		CV
					LL	UL	
PHILIPPINES		**3,644**	**20.8**	**0.77**	**19.3**	**22.40**	**3.7**
	NCR	257	13.6	2.08	10.04	18.24	15.2
	CAR	165	15.0	3.04	9.99	22.01	20.2
I.	**Ilocos**	268	21.1	2.46	16.71	26.38	11.6
II.	**Cagayan Valley**	224	38.5	3.34	32.15	45.19	8.7
III.	**Central Luzon**	332	25.1	2.79	19.99	30.91	11.1
IV-A.	**CALABARZON**	302	26.7	2.37	22.30	31.59	8.9
IV-B.	**MIMAROPA**	187	21.2	3.18	15.62	28.11	15.0
V.	**Bicol**	216	17.1	2.99	12.02	23.81	17.5
VI.	**Western Visayas**	276	25.3	2.58	20.52	30.65	10.2
VII.	**Central Visayas**	286	21.6	2.78	16.69	27.00	12.8
VIII.	**Eastern Visayas**	220	11.8	1.97	8.47	16.28	16.7
IX.	**Zamboanga Peninsula**	155	13.5	2.59	9.16	19.41	19.2
X.	**Northern Mindanao**	174	18.4	3.09	13.08	25.23	16.8
XI.	**Davao**	170	10.3	2.84	5.89	17.35	27.6
XII.	**SOCCSKSARGEN**	177	21.2	3.48	15.17	28.82	16.4
	ARMM	68	34.9	5.84	24.44	47.03	16.7
	CARAGA	167	14.5	3.83	8.44	23.71	26.5

Appendix 6. Percent distribution of serum retinol among preschool children, 5 months -5 years old by region: Philippines, 2013

Region		n	SerumRetinol Mean ± SE	Percent Distribution		
				Def & low	Acceptable	High
PHILIPPINES		**3139**	**26.4 ± 0.3**	**20.4**	**78.4**	**1.3**
	NCR	219	23.5 ± 0.8	27.3	72.7	0.0
	CAR	155	28.8 ± 0.9	12.5	84.5	3.0
I.	**Ilocos**	201	25.4 ± 0.9	26.1	72.9	1.0
II.	**Cagayan Valley**	174	28.6 ± 1.0	12.8	84.9	2.3
III.	**Central Luzon**	304	28.0 ± 0.6	10.4	88.6	1.0
IV-A.	**CALABARZON**	324	27.4 ± 0.6	14.6	84.5	0.9
IV-B.	**MIMAROPA**	123	26.4 ± 0.9	19.0	80.2	0.8
V.	**Bicol**	115	24.5 ± 0.4	27.7	72.3	0.0
VI.	**Western Visayas**	196	27.8 ± 0.6	18.3	77.1	4.6
VII.	**Central Visayas**	227	26.4 ± 1.0	22.2	77.0	0.8
VIII.	**Eastern Visayas**	123	27.4 ± 1.9	20.2	78.9	1.0
IX.	**Zamboanga Peninsula**	158	25.6 ± 1.5	32.7	64.7	2.6
X.	**Northern Mindanao**	197	27.4 ± 0.9	21.0	76.4	2.6
XI.	**Davao**	193	24.6 ± 0.8	24.5	75.0	0.6
XII.	**SOCCSKSARGEN**	217	25.5 ± 1.0	26.2	72.4	1.4
	ARMM	121	27.5 ± 1.2	22.0	77.2	0.9
	CARAGA	92	25.3 ± 0.9	19.8	79.0	1.2

Appendix 7. Percent distribution of serum retinol among school-aged children, 6 -12 years old by region: Philippines, 2013

Region		N	SerumRetinol Mean ± SE	Percent Distribution		
				Def & low	Acceptable	High
PHILIPPINES		**5752**	**29.7 ± 0.2**	**10.7**	**86.7**	**2.6**
	NCR	433	28.1 ± 0.7	13.9	84.0	2.0
	CAR	269	33.3 ± 0.9	6.5	86.6	6.9
I.	Ilocos	331	29.5 ± 1.0	10.4	86.5	3.2
II.	Cagayan Valley	261	30.7 ± 1.0	8.2	89.3	2.5
III.	Central Luzon	480	31.2 ± 0.4	3.2	94.6	2.2
IV-A.	CALABARZON	541	30.9 ± 0.7	7.3	89.7	2.9
IV-B.	MIMAROPA	285	29.6 ± 0.7	9.2	87.8	3.0
V.	Bicol	295	27.1 ± 1.1	19.1	78.9	2.0
VI.	Western Visayas	378	29.1 ± 1.2	16.1	80.3	3.6
VII.	Central Visayas	363	28.5 ± 0.6	9.8	88.3	1.9
VIII.	Eastern Visayas	320	29.7 ± 1.1	16.9	79.8	3.3
IX.	Zamboanga Peninsula	281	27.7 ± 1.4	21.4	76.3	2.2
X.	Northern Mindanao	314	30.9 ± 0.9	5.9	91.6	2.5
XI.	Davao	355	31.1 ± 0.9	7.4	90.2	2.4
XII.	SOCCSKSARGEN	357	30.3 ± 0.7	9.4	88.3	2.3
	ARMM	257	30.8 ± 1.2	10.3	87.7	2.0
	CARAGA	232	27.7 ± 0.9	14.4	84.4	1.2

Appendix 8. Percent distribution of serum retinol among adolescents, 13 – 19 years old by region: Philippines 2013

Region		n	SerumRetinol Mean ± SE	Percent Distribution		
				Def & low	Acceptable	High
PHILIPPINES		**5,463**	**36.4 ± 0.3**	**4.0**	**85.1**	**10.9**
	NCR	441	33.1 ± 0.4	9.2	83.7	7.1
	CAR	204	43.3 ±0.9	0.0	74.3	25.7
I.	**Ilocos**	337	36.9 ± 1.1	3.3	83.2	13.5
II.	**Cagayan Valley**	288	38.4 ± 1.0	2.1	84.2	13.7
III.	**Central Luzon**	456	38.8 ± 0.6	0.8	85.4	13.8
IV-A.	**CALABARZON**	475	36.2 ±0.6	1.8	90.6	7.6
IV-B.	**MIMAROPA**	260	35.0 ± 0.8	2.4	90.0	7.6
V.	**Bicol**	307	36.8 ± 0.8	2.4	87.1	10.5
VI.	**Western Visayas**	394	35.6 ± 1.6	7.9	77.8	14.3
VII.	**Central Visayas**	390	36.0 ± 0.9	3.7	87.5	8.8
VIII.	**Eastern Visayas**	311	35.7 ± 1.9	6.6	81.5	11.8
IX.	**Zamboanga Peninsula**	261	34.7 ± 1.0	6.9	82.9	10.3
X.	**Northern Mindanao**	287	36.8 ± 0.7	2.5	87.9	9.6
XI.	**Davao**	325	39.0 ± 0.9	0.9	87.9	11.2
XII.	**SOCCSKSARGEN**	329	39.4 ± 1.1	1.7	81.1	17.2
	ARMM	214	35.4 ± 1.5	4.6	86.1	9.3
	CARAGA	184	36.0 ± 0.9	3.7	87.3	9.0

Appendix 9. Percent distribution of serum retinol among adults, 20 – 59 years old, by region: Philippines 2013

Region		n	SerumRetinol Mean ± SE	Percent Distribution		
				Def & low	Acceptable	High
PHILIPPINES		**14,589**	**46.0 ± 0.3**	**2.1**	**61.9**	**36.0**
	NCR	1252	43.8 ± 0.8	2.4	66.5	31.1
	CAR	601	51.5 ± 1.2	1.2	50.9	47.9
I.	**Ilocos**	922	48.4 ± 1.2	3.4	53.9	42.8
II.	**Cagayan Valley**	774	53.8 ± 1.4	0.6	44.3	55.1
III.	**Central Luzon**	1371	48.5 ± 0.6	0.5	57.2	42.3
IV-A.	**CALABARZON**	1465	44.4 ± 0.7	1.8	66.9	31.3
IV-B.	**MIMAROPA**	582	46.1 ± 0.8	1.7	60.5	37.8
V.	**Bicol**	680	45.1 ± 1.1	2.6	63.2	34.2
VI.	**Western Visayas**	982	44.0 ± 1.8	3.8	65.1	31.3
VII.	**Central Visayas**	1056	43.2 ± 1.0	2.1	70.3	27.6
VIII.	**Eastern Visayas**	714	46.3 ± 1.7	2.7	59.4	37.9
IX.	**Zamboanga Peninsula**	637	43.6 ± 1.7	4.7	65.8	29.5
X.	**Northern Mindanao**	781	46.5 ± 0.7	1.6	60.7	37.7
XI.	**Davao**	893	48.0 ± 0.9	1.1	56.7	42.2
XII.	**SOCCSKSARGEN**	872	49.9 ± 1.2	2.4	50.1	47.5
	ARMM	457	42.8 ± 1.9	2.5	70.2	27.3
	CARAGA	550	44.8 ± 1.2	1.1	68.0	30.9

Appendix 10. Percent distribution of serum retinol among elderly, ≥ 60 years old, by region: Philippines, 2013

Region		n	SerumRetinol Mean ± SE	Percent Distribution		
				Def & low	Acceptable	High
PHILIPPINES		**3,619**	**47.3 ± 0.4**	**3.0**	**57.0**	**40.0**
	NCR	252	50.3 ± 1.6	1.9	50.8	47.4
	CAR	165	53.2 ± 1.7	1.8	42.1	56.1
I.	**Ilocos**	268	46.5 ± 1.2	4.7	55.6	39.7
II.	**Cagayan Valley**	224	49.3 ± 1.6	1.7	55.8	42.5
III.	**Central Luzon**	329	49.5 ± 1.2	1.5	54.1	44.4
IV-A.	**CALABARZON**	302	46.8 ± 0.9	1.5	60.5	38.0
IV-B.	**MIMAROPA**	186	44.8 ± 1.3	4.1	58.5	37.4
V.	**Bicol**	216	45.9 ± 1.1	2.9	58.7	38.4
VI.	**Western Visayas**	273	42.5 ± 1.6	8.1	62.0	29.9
VII.	**Central Visayas**	285	44.8 ± 1.5	2.2	63.7	34.1
VIII.	**Eastern Visayas**	220	46.1 ± 2.0	3.8	58.0	38.2
IX.	**Zamboanga Peninsula**	152	45.4 ± 2.7	4.3	58.7	37.1
X.	**Northern Mindanao**	173	45.8 ± 1.1	4.9	56.7	38.5
XI.	**Davao**	169	47.9 ± 1.3	1.2	60.3	38.6
XII.	**SOCCSKSARGEN**	176	55.1 ± 2.3	3.2	44.6	52.1
	ARMM	68	43.9 ± 2.5	0.0	68.5	31.5
	CARAGA	161	45.8 ± 1.3	2.4	61.2	36.4

Appendix 11. Mean serum zinc and prevalence of zinc deficiency among preschool children, 6 months - 5 years old by region: Philippines 2013

Age/ Physiologic State		n	Serum zinc, µg/dL Mean ± SE	% Prevalence	95% CI LL	95% CI UL
PHILIPPINES		3,124	82.1 ± 0.6	17.9	16.3	19.7
	NCR	223	84.3 ± 1.7	13.1	9.4	17.9
	CAR	148	77.5 ± 1.9	21.2	13.9	31.1
I	Ilocos	203	87.4 ± 1.9	9.9	6.3	15.1
II	Cagayan Valley	178	84.4 ± 2.8	6.6	3.0	13.6
III	Central Luzon	304	86.6 ± 1.7	9.0	5.6	14.4
IV-A.	CALABARZON	322	91.0 ± 0.2	11.8	8.5	16.3
IV-B.	MIMAROPA	120	75.0 ± 2.4	22.1	14.7	31.8
V.	Bicol	114	74.1 ± 2.4	30.4	19.6	43.9
VI.	Western Visayas	195	73.4 ± 1.6	30.4	23.5	38.4
VII.	Central Visayas	218	86.8 ± 1.8	10.5	6.6	16.4
VIII	Eastern Visayas	117	74.2 ± 1.5	21.6	16.2	28.3
IX.	Zamboanga Peninsula	158	74.0 ± 1.9	32.7	24.2	42.5
X.	Northern Mindanao	198	75.5 ± 2.0	27.1	18.1	38.5
XI.	Davao	198	81.1 ± 2.1	18.9	13.9	25.2
XII	SOCCSKSARGEN	216	70.0 ± 2.3	42.6	33.1	52.7
	ARMM	119	75.6 ± 2.5	25.2	18.0	34.2
	CARAGA	93	78.5 ± 1.7	16.9	10.5	26.0

Appendix 12. Mean serum zinc and prevalence of zinc deficiency among school-aged children, 6 -12 years old by region: Philippines 2013

	Age/ Physiologic State	n	Serum zinc, µg/dL Mean ± SE	% Prevalence	95% CI LL	95% CI UL
PHILIPPINES		5,761	79.5 ± 0.4	21.6	19.9	23.4
	NCR	429	80.5 ± 1.1	15.7	11.1	21.9
	CAR	268	79.0 ± 1.6	22.3	15.8	30.5
I	Ilocos	331	84.2 ± 1.5	9.7	5.1	17.9
II	Cagayan Valley	260	81.4 ± 1.0	11.5	8.6	15.1
III	Central Luzon	482	83.7 ± 1.1	12.7	9.4	16.9
IV-A.	CALABARZON	540	88.9 ± 1.6	12.9	9.5	17.2
IV-B.	MIMAROPA	285	72.1 ± 1.5	35.0	26.0	45.2
V.	Bicol	294	73.4 ± 1.4	33.8	28.0	40.2
VI.	Western Visayas	377	73.5 ± 1.8	37.0	28.7	46.2
VII.	Central Visayas	364	84.5 ± 1.1	9.6	7.4	12.4
VIII	Eastern Visayas	321	73.9 ± 1.5	26.7	19.3	35.7
IX.	Zamboanga Peninsula	282	71.7 ± 1.5	35.8	29.0	43.2
X.	Northern Mindanao	313	74.9 ± 1.3	28.6	20.0	39.0
XI.	Davao	358	79.3 ± 2.0	21.4	13.5	32.3
XII	SOCCSKSARGEN	358	70.7 ± 1.3	41.3	33.0	50.2
	ARMM	261	71.2 ± 1.1	36.3	28.3	45.2
	CARAGA	238	75.0 ± 1.2	22.7	17.4	29.2

Appendix 13. Mean serum zinc and prevalence of zinc deficiency among adolescents, 13 – 19 years old by region: Philippines 2013

	Age/ Physiologic State	n	Serum zinc,µg/dL Mean ± SE	% Prevalence	95% CI LL	95% CI UL
PHILIPPINES		5,392	79.8 ± 0.5	23.6	21.8	25.4
	NCR	393	70.8 ± 1.3	40.0	34.2	46.0
	CAR	174	73.7 ± 2.3	39.5	27.2	53.3
I	Ilocos	338	86.2 ± 1.4	10.4	6.3	16.6
II	Cagayan Valley	287	82.5 ± 1.1	15.6	11.1	21.4
III	Central Luzon	456	85.1 ± 0.9	11.1	7.7	15.6
IV-A.	CALABARZON	474	87.9 ± 1.3	15.0	11.7	19.1
IV-B.	MIMAROPA	260	78.9 ± 1.1	26.8	19.8	35.3
V.	Bicol	305	78.0 ± 1.6	28.2	22.3	35.0
VI.	Western Visayas	394	74.1 ± 1.4	33.3	27.0	40.3
VII.	Central Visayas	391	84.2 ± 1.2	11.5	7.9	16.6
VIII	Eastern Visayas	310	79.5 ± 1.5	23.6	15.8	33.6
IX.	Zamboanga Peninsula	263	73.9 ± 1.8	35.3	27.1	44.4
X.	Northern Mindanao	288	77.4 ± 2.1	28.9	20.7	38.7
XI.	Davao	328	82.0 ± 1.7	18.3	13.3	24.7
XII	SOCCSKSARGEN	329	74.5 ± 1.3	30.1	30.1	37.7
	ARMM	215	74.6 ± 1.6	26.3	18.2	36.4
	CARAGA	187	76.9 ± 1.0	20.2	14.7	27.2

Appendix 14. Mean serum zinc and prevalence of zinc deficiency among adults, 20 – 59 years old by region: Philippines 2013

	Age/ Physiologic State	n	Serum zinc,µg/dL Mean ± SE	% Prevalence	95% CI LL	95% CI UL
PHILIPPINES		14,496	81.9 ± 0.4	28.1	26.6	29.6
	NCR	1,192	73.7 ± 1.0	44.3	39.9	48.8
	CAR	562	80.1 ± 1.2	30.8	25.7	36.4
I	Ilocos	921	88.9 ± 1.1	13.3	9.3	18.7
II	Cagayan Valley	769	84.8 ± 1.3	19.7	15.1	25.4
III	Central Luzon	1,370	87.1 ± 1.1	14.8	11.6	18.6
IV-A.	CALABARZON	1,460	88.8 ± 1.1	18.9	16.3	21.8
IV-B.	MIMAROPA	585	78.7 ± 0.9	30.3	25.8	35.2
V.	Bicol	676	77.6 ± 1.5	34.6	26.1	44.2
VI.	Western Visayas	988	75.9 ± 0.9	39.8	34.9	44.8
VII.	Central Visayas	1,054	85.7 ± 0.8	17.2	14.1	20.7
VIII	Eastern Visayas	715	80.2 ± 1.4	30.2	23.3	38.1
IX.	Zamboanga Peninsula	637	77.6 ± 1.4	37.7	29.5	46.8
X.	Northern Mindanao	781	77.2 ± 1.2	36.1	29.7	43.0
XI.	Davao	895	87.7 ± 1.5	23.2	18.5	28.6
XII	SOCCSKSARGEN	874	74.9 ± 0.7	45.4	40.8	50.0
	ARMM	460	75.4 ± 0.9	37.3	30.7	44.3
	CARAGA	557	83.9 ± 1.3	21.8	17.5	26.8

Appendix 15. Mean serum zinc and prevalence of zinc deficiency among the elderly, ≥ 60 years old by region: Philippines 2013

Age/ Physiologic State		n	Serum zinc, µg/dL Mean ± SE	% Prevalence	95% CI LL	95% CI UL
PHILIPPINES		3,604	77.5 ± 0.5	36.3	34.1	38.6
	NCR	239	70.6 ± 1.3	49.9	42.3	57.5
	CAR	156	72.2 ± 1.7	50.2	40.7	59.7
I	Ilocos	267	82.3 ± 1.7	22.5	16.3	30.2
II	Cagayan Valley	223	78.9 ± 1.8	34.5	27.7	42.0
III	Central Luzon	328	81.4 ± 1.4	24.0	18.0	31.3
IV-A.	CALABARZON	301	85.7 ± 1.8	26.4	20.7	33.0
IV-B.	MIMAROPA	186	73.2 ± 1.9	43.9	32.7	55.8
V.	Bicol	216	74.7 ± 2.1	43.5	35.0	52.3
VI.	Western Visayas	276	71.7 ± 1.0	49.2	40.6	57.9
VII.	Central Visayas	283	80.8 ± 1.3	26.6	21.9	31.8
VIII	Eastern Visayas	220	76.7 ± 1.4	32.5	25.1	40.8
IX.	Zamboanga Peninsula	155	71.9 ± 1.5	47.2	38.0	56.6
X.	Northern Mindanao	174	75.3 ± 1.6	38.7	30.2	47.9
XI.	Davao	168	84.0 ± 2.2	26.4	18.1	36.8
XII	SOCCSKSARGEN	177	72.2 ± 1.4	51.1	44.5	58.3
	ARMM	68	70.3 ± 3.6	66.1	54.7	75.9
	CARAGA	167	78.7 ± 1.4	33.7	28.0	39.9

Appendix 16. Median and Prevalence of UIE <50 ug/L among 6 -12 years old school children in Luzon by region and province: Philippines 2013

Region	n	Median (P20, 80) µg/L	% <50 µg/L(95% CI)
PHILIPPINES	**22,588**	**168 (63, 322)**	**16.4 (15.7, 17.1)**
NCR	**1,905**	**220 (104, 357)**	**8.9 (7.6, 10.3)**
First District	281	219 (105, 391)	9.1 (6.1, 12.0)
Second District	618	230 (126, 366)	6.2 (4.3, 8.0)
Third District	477	221(91, 339)	11.2 (8.2, 14.1)
Fourth District	529	207 (94, 354)	10.5 (7.9, 13.2)
CAR	**864**	**123 (39, 270)**	**26.4 (20.5, 32.3)**
Abra	168	70 (19, 169)	41.7 (28.8, 54.5)
Benguet	306	146 (45, 303)	23.4 (14.2, 32.7)
Ifugao	103	105 (39, 231)	25.0 (16.2, 33.9)
Kalinga	138	196 (77, 319)	16.3 (3.1, 29.6)
Mountain Province	86	87 (27, 207)	33.6 (12.9, 54.4)
I ILOCOS REGION	**1,336**	**173 (59, 342)**	**17.5 (14.4, 20.6)**
Apayao	63	173 (52, 309)	16.1 (12.8, 19.5)
Ilocos Sur	194	161 (57, 286)	18.0 (8.5, 27.5)
La Union	178	134 (37, 290)	27.2 (16.2, 38.3)
Pangasinan	797	175 (62, 349)	16.5 (12.7, 20.4)
II CAGAYAN VALLEY	**995**	**223 (92, 389)**	**10.6 (8.0, 13.2)**
Cagayan	330	247 (109, 421)	8.2 (3.3, 13.0)
Isabela	477	219 (96, 378)	10.0 (6.0, 14.0)
Nueva Vizcaya	117	141 (55, 310)	17.6 (12.5, 22.7)
Quirino	71	259 (110, 444)	13.8 (4.2, 23.4)
III CENTRAL LUZON	**1,818**	**203 (83, 400)**	**11.3 (9.3, 13.3)**
Bataan	123	119 (41, 256)	25.5 (18.3, 32.6)
Bulacan	485	258 (107, 522)	8.1 (5.0, 11.2)
Nueva Ecija	363	191 (75, 329)	14.1 (9.1, 19.0)
Pampanga	432	218 (102, 408)	7.4 (3.9, 10.9)
Tarlac	229	232 (101, 404)	8.7 (4.1, 13.4)
Zambales	144	128 (61, 250)	15.8 (6.7, 25.0)
Aurora	42	112 (28, 195)	26.1 (1.1, 51.1)
IV-A CALABARZON	**2,028**	**236 (107 , 383)**	**8.1 (6.7 , 9.5)**
Batangas	350	182 (73 , 324)	13.0 (9.3 , 16.6)
Cavite	447	274 (113 , 410)	8.1 (5.0 , 11.2)
Laguna	416	240 (116 , 386)	5.8 (2.9 , 8.6)
Quezon	440	249 (120 , 415)	7.1 (3.9 , 10.3)
Rizal	375	222 (116 , 362)	7.3 (4.7 , 9.9)
IV-B MIMAROPA	**1,046**	**136 (51 , 273)**	**19.5 (15.8 , 23.3)**
Marinduque	102	245 (106 , 407)	5.9 (-0.3 , 12.0)
Occidental Mindoro	183	104 (48 , 222)	20.9 (16.3 , 25.5)
Oriental Mindoro	343	184 (87 , 334)	11.0 (3.6 , 18.4)
Palawan	307	92 (30 , 199)	31.8 (25.0 , 38.6)
Romblon	111	145 (59 , 238)	19.0(9.1 , 28.9)
V BICOL	**1,719**	**150 (53, 297)**	**18.7 (16.6, 20.8)**
Albay	340	145 (37, 307)	24.3 (18.3, 30.2)
Camarines Norte	157	154 (59, 304)	18.7 (7.9, 29.5)
Camarines Sur	525	167 (62, 306)	16.6 (12.6, 20.5)
Catanduanes	62	217 (77, 389)	17.0 (-2.9, 37.0)
Masbate	303	138 (65, 224)	17.4 (11.6, 23.1)
Sorsorgon	332	145 (57, 309)	17.6 (15.2, 19.9)

Appendix 17. Median and prevalence of UIE <50 ug/L among 6 -12 years old school children in Visayas by region and province: Philippines, 2013

	Region	n	Median (P20, 80) µg/L	% <50 µg/L (95% CI)
PHILIPPINES		**22,588**	**168 (63, 322)**	**16.4 (15.7, 17.1)**
VI	**WESTERN VISAYAS**	**1,464**	**125 (42, 259)**	**23.4 (20.5, 26.4)**
	Aklan	74	148 (58, 253)	17.1 (5.5, 28.7)
	Antique	110	102 (39, 251)	27.0 (13.8, 40.2)
	Capiz	194	99 (22, 304)	33.8 (22.4, 45.2)
	Iloilo	465	158 (56, 297)	17.7 (12.8, 22.5)
	Negros Occidental	577	112 (45, 222)	22.7 (18.6, 26.9)
	Guimaras	44	48 (19, 212)	52.2 (26.7, 77.8)
VII	**CENTRAL VISAYAS**	**1,508**	**166 (69, 304)**	**14.7 (11.7, 17.7)**
	Bohol	311	174 (71, 310)	14.6 (8.3, 21.0)
	Cebu	874	179 (73, 326)	13.2 (8.9, 17.6)
	Negros Oriental	300	118 (51, 229)	19.7 (14.7, 24.7)
	Siquijor	23	187 (103, 299)	7.8 (-3.3, 18.8)
IX	**EASTERN VISAYAS**	**1,432**	**161 (67, 284)**	**15.4 (12.9, 18.0)**
	Eastern Samar	153	150 (27, 303)	28.4 (20.5, 36.2)
	Leyte	524	158 (75, 276)	14.4 (10.7, 18.1)
	Northern Samar	241	180 (86, 286)	12.0 (6.4, 17.6)
	Western Samar	293	167 (76, 297)	12.5 (7.4, 17.6)
	Southern Leyte	132	155 (68, 334)	14.7 (4.8, 24.7)
	Biliran	89	145 (46, 225)	20.0 (11.2, 28.8)

Appendix 18. Median and prevalence of UIE <50 ug/L among 6 -12 years old school children in Mindanao by region and province: Philippines 2013

Region		n	Median (P20, 80) µg/L	% <50 µg/L(95% CI)
PHILIPPINES		22,588	168 (63, 322)	16.4 (15.7, 17.1)
IX	ZAMBOANGA PENINSULA	1,039	**68 (19, 161)**	**41.1 (36.6, 45.6)**
	Zamboanga Del Norte	342	41 (14, 101)	55.5 (45.9, 65.0)
	Zamboanga Del Sur	494	93 (30, 201)	31.2 (25.2, 37.2)
	Zamboanga Sibugay	168	71 (22, 166)	40.7 (33.6, 47.8)
	Isabela City	35	51 (29, 161)	45.0 (14.8, 75.2)
X	NORTHERN MINDANAO	1,095	**121 (38, 247)**	**23.6 (20.1, 27.1)**
	Bukidnon	307	99 (21, 195)	33.3 (26.1, 40.4)
	Camiguin	38	157 (67, 268)	13.7 (3.2, 24.2)
	Lanao Del Norte	243	138 (64, 259)	15.1 (7.5, 22.6)
	Misamis Occidental	170	94 (31, 229)	26.4 (16.5, 36.4)
	Misamis Oriental	337	145 (49, 290)	20.2 (14.4, 26.0)
XI	DAVAO REGION	1,090	**122 (43, 248)**	**24.3 (20.5, 28.1)**
	Davao Del Norte	217	147 (48, 264)	21.3 (14.4, 28.2)
	Davao Del Sur	549	128 (44, 256)	23.0 (17.7, 28.4)
	Davao Oriental	159	98 (26, 217)	29.3 (22.5, 36.1)
	Compostela Valley	165	101 (34, 206)	27.8 (16.2, 39.5)
XII	SOCCSKSARGEN	1,185	**137 (50, 293)**	**19.9 (16.4, 23.4)**
	North Cotabato	357	156 (67, 403)	14.4 (8.5, 20.3)
	South Cotabato	428	117 (31, 253)	26.0 (21.0, 31.1)
	Sultan Kudarat	190	124 (40, 234)	24.8 (14.9, 34.8)
	Sarangani	164	151 (67, 322)	11.9 (4.7, 19.1)
	Cotabato City	46	149 (65, 278)	14.3 (-1.6, 30.3)
ARMM		1,025	**128 (48, 257)**	**20.6 (17.5, 23.7)**
	Basilan	82	120 (45, 234)	22.3 (7.6, 37.0)
	Lanao Del Sur	355	99 (40, 194)	24.4 (18.1, 30.6)
	Maguindanao	298	133 (50, 277)	19.9 (15.8, 24.0)
	Sulu	146	153 (46, 274)	24.2 (13.1, 35.2)
	Tawi-Tawi	144	197 (83, 315)	7.7 (3.5, 12.0)
CARAGA		1,039	**128 (55, 243)**	**18.1 (15.1, 21.2)**
	Agusan Del Norte	265	174 (81, 310)	9.9 (6.9, 12.8)
	Agusan Del Sur	250	105 (38, 227)	24.9 (16.1, 33.7)
	Surigao Del Norte	231	127 (71, 212)	16.8 (11.4, 22.1)
	Surigao Del Sur	293	112 (48, 215)	21.0 (15.7, 26.3)

Appendix 19. Median and prevalence of UIE <50 µg/L among adolescents, 13 -19 years old by region: Philippines, 2013

Region		n	Median (P20, 80) µg/L	% <50 µg/L(95% CI)
PHILIPPINES		**5,514**	**134 (50, 264)**	**19.8 (18.5, 21.2)**
	NCR	453	186 (67, 301)	15.4 (12.3, 19.2)
	CAR	197	102 (35, 225)	28.5 (23.2, 34.5)
I.	Ilocos	325	129 (49, 234)	20.1 (14.7, 26.9)
II.	Cagayan Valley	285	115 (44, 261)	23.9 (17.6, 31.6)
III.	Central Luzon	464	162 (68, 291)	14.7 (11.3, 19.0)
IV-A.	CALABARZON	488	206 (84, 357)	10.0 (7.1, 13.9)
IV-B.	MIMAROPA	264	133 (52, 243)	18.8 (13.1, 26.2)
V.	Bicol	350	113 (53, 217)	18.5 (14.1, 23.8)
VI.	Western Visayas	391	119 (43, 242)	24.0 (19.3, 29.6)
VII.	Central Visayas	387	120 (47, 230)	21.6 (17.6, 26.1)
VIII.	Eastern Visayas	321	128 (67, 237)	12.9 (8.8,18.7)
IX.	Zamboanga Peninsula	265	76 (25, 182)	39.4 (31.3, 48.2)
X.	Northern Mindanao	293	121 (41, 211)	24.7 (21.7, 27.9)
XI.	Davao	316	92 (34, 187)	28.3 (22.1, 35.4)
XII.	SOCCSKSARGEN	319	99 (31, 221)	29.0 (24.4, 34.1)
	ARMM	205	104 (39, 220)	26.2 (15.5, 40.6)
	CARAGA	191	104 (33, 238)	28.0 (22.6, 34.1)

Appendix 20. Median and prevalence of UIE <50 µg/L among adults, 20 -59 years old by region: Philippines, 2013

Region		n	Median (P20, 80) µg/L	% <50 µg/L(95% CI)
PHILIPPINES		**14,820**	**116 (44, 225)**	**22.4 (21.3,23.6)**
	NCR	1,287	139 (49, 244)	20.2 (17.0, 23.7)
	CAR	600	89 (33, 183)	30.7 (22.2, 40.6)
I.	Ilocos	918	104 (38, 205)	24.8 (19.7, 30.8)
II.	Cagayan Valley	794	101 (45, 205)	21.7 (17.2, 27.1)
III.	Central Luzon	1,366	116 (49, 231)	20.3 (16.7, 24.3)
IV-A.	CALABARZON	1,514	171 (84, 289)	11.4 (9.4, 13.8)
IV-B.	MIMAROPA	595	117 (49, 205)	20.2 (17.0, 23.9)
V.	Bicol	746	110 (46, 203)	21.8 (18.8, 25.2)
VI.	Western Visayas	992	100 (31, 207)	28.0 (24.4, 32.0)
VII.	Central Visayas	1,046	105 (40, 197)	25.1 (22.8, 27.6)
VIII.	Eastern Visayas	750	125 (62, 227)	14.5 (11.9, 17.7)
IX.	Zamboanga Peninsula	666	66 (24, 142)	38.4 (31.2, 46.1)
X.	Northern Mindanao	786	87 (34, 175)	28.7 (25.5, 32.1)
XI.	Davao	887	88 (34, 166)	31.2 (28.0, 34.5)
XII.	SOCCSKSARGEN	839	99 (30, 206)	29.7 (24.1, 36.1)
	ARMM	449	83 (28, 165)	31.9 (25.7, 38.8)
	CARAGA	585	103 (41, 199)	23.9 (18.4, 30.6)

Appendix 21. Median and prevalence of UIE <50 µg/L among the elderly, ≥ 60 years by region: Philippines, 2013

	Region	n	Median (P20, 80) µg/L	% <50 µg/L(95% CI)
PHILIPPINES		**3,676**	**80 (27, 168)**	**33.7 (31.7, 35.8)**
	NCR	276	87 (21, 185)	36.9 (30.9, 43.3)
	CAR	164	69 (19, 149)	40.9 (33.1, 49.2)
I.	Ilocos	265	62 (20, 159)	43.5 (35.1, 52.3)
II.	Cagayan Valley	220	79 (27, 162)	38.5 (32.7, 44.8)
III.	Central Luzon	329	87 (42, 165)	25.1 (20.1, 31.0)
IV-A.	CALABARZON	307	112 (44, 227)	22.7 (17.6, 28.8)
IV-B.	MIMAROPA	184	67 (28, 140)	37.3 (29.6, 45.7)
V.	Bicol	231	74 (28, 153)	34.1 (27.0, 42.0)
VI.	Western Visayas	275	79 (21, 158)	33.0 (27.2, 39.4)
VII.	Central Visayas	284	83 (26, 154)	32.8 (27.2, 38.9)
VIII.	Eastern Visayas	235	108 (50, 191)	19.8 (13.7, 27.7)
IX.	Zamboanga Peninsula	161	43 (17, 98)	56.5 (46.5, 66.1)
X.	Northern Mindanao	171	58 (23, 113)	44.1 (36.6, 51.9)
XI.	Davao	168	58 (21, 121)	45.4 (38.1, 52.8)
XII.	SOCCSKSARGEN	171	61 (21, 177)	42.1 (28.5, 57.1)
	ARMM	68	81 (30, 170)	33.2 (21.3, 47.8)
	CARAGA	167	96 (46, 171)	21.8 (16.9, 27.7)

Appendix 22. Median and prevalence of UIE <50 µg/L among lactating mothers by region: Philippines, 2013

	Region	n	Median (P20, 80) µg/L	% <50 µg/L(95% CI)
PHILIPPINES		**1,460**	**77 (27, 167)**	**34.3 (31.7, 36.9)**
	NCR	108	98 (33, 205)	27.4 (19.6, 35.3)
	CAR	72	60 (19, 136)	41.8 (28.7, 55.0)
I.	Ilocos	76	55 (19, 163)	44.9 (31.4, 58.4)
II.	Cagayan Valley	85	98 (43, 195)	23.6 (12.4, 34.7)
III.	Central Luzon	79	84 (29, 168)	29.3 (18.5, 40.2)
IV-A.	CALABARZON	130	94 (30, 214)	33.8 (25.7, 41.8)
IV-B.	MIMAROPA	60	51 (24, 116)	47.2 (27.8, 66.6)
V.	Bicol	114	93 (26, 164)	29.5 (20.1, 38.9)
VI.	Western Visayas	105	62 (19, 123)	41.1 (30.3, 51.8)
VII.	Central Visayas	98	87 (33, 207)	25.7 (15.1, 36.3)
VIII.	Eastern Visayas	100	87 (33, 164)	31.3 (22.7, 39.8)
IX.	Zamboanga Peninsula	71	48 (20, 125)	50.3 (44.7, 55.9)
X.	Northern Mindanao	72	53 (19, 133)	48.7 (37.1, 60.2)
XI.	Davao	63	65 (30, 110)	41.9 (29.4, 54.4)
XII.	SOCCSKSARGEN	83	75 (21, 136)	34.7 (22.6, 46.8)
	ARMM	69	94 (23, 172)	28.6 (13.3, 43.9)
	CARAGA	75	85 (38, 167)	29.4 (16.0, 42.7)

Appendix 23. Median and prevalence of UIE <50 µg/L among pregnant women by region: Philippines, 2013

Region		n	Median (P20, 80) µg/L	% <50 µg/L (95% CI)
PHILIPPINES		**1,095**	**105 (34, 213)**	**27.0 (24.1, 29.8)**
	NCR	98	157 (78, 238)	15.4 (6.2, 24.7)
	CAR	35	68 (21, 182)	46.9 (35.4, 58.4)
I.	**Ilocos**	62	106 (34, 217)	27.9 (18.3, 37.5)
II.	**Cagayan Valley**	51	79 (29, 170)	31.1 (20.5, 41.8)
III.	**Central Luzon**	93	116 (40, 245)	26.8 (14.3, 39.2)
IV-A.	**CALABARZON**	131	131 (42, 254)	22.0 (17.0, 26.9)
IV-B.	**MIMAROPA**	42	63 (31, 179)	29.4 (19.4, 39.4)
V.	**Bicol**	67	120 (27, 240)	26.2 (11.3, 41.1)
VI.	**Western Visayas**	65	68 (24, 136)	37.9 (27.1, 48.7)
VII.	**Central Visayas**	77	111 (31, 209)	26.2 (19.7, 32.7)
VIII.	**Eastern Visayas**	56	104 (54, 181)	18.4 (6.6, 30.1)
IX.	**Zamboanga Peninsula**	56	51 (23, 167)	46.9 (36.9, 56.8)
X.	**Northern Mindanao**	53	64 (20, 183)	43.4 (30.7, 56.0)
XI.	**Davao**	41	80 (41, 167)	32.2 (21.5, 43.0)
XII.	**SOCCSKSARGEN**	55	90 (21, 164)	33.7 (22.6, 44.8)
	ARMM	53	100 (32, 246)	26.2 (10.7, 41.8)
	CARAGA	60	86 (45, 163)	22.5 (11.4, 33.6)

7. ANNEX

Annex 1: Hemoglobin determination by cyanmethemoglobin method

HEMOGLOBIN DETERMINATION

*by Cyanmethemoglobin Method**

Analysts: *Registered Medical Technologists (RMTs) with training on quality assurance for biological specimen collection and hemoglobin determination*

Preparation and standardization of cyanmethemoglobin reagent

- Dissolve 200 mg of potassium ferricyanide ($K_3Fe(CN)_6$), 50 mg potassium cyanide (KCN), 140 mg of dihydrogen potassium phosphate ($KH2PO_4$) (analytic grade chemicals) and 1 mL non-ionic detergent in distilled water. Mix well and dilute to 1 liter. Let stand overnight.
- Determine pH of the reagent. The pH should be between 7.0 – 7.4.
- Store the reagent in brown borosilicate bottle at room temperature. The reagent is stable for six (6) months.
- Prepare the standard solution by diluting 20 µL of the standard blood sample with 5 mL cyanmethemoglobin reagent.
- Prepare 6 tubes and prepare 6-pt dilutions of the Hb standard as follows:

No.	Standard solution (mL)	Cyanmeth reagent (mL)	Hb conc of Standard (g/dL)
1	6	0	18.0*
2	5	1	15.0
3	4	2	12.0
4	3	3	9.0
5	2	4	6.0
6	1	5	3.0

**Based on the certified Hb value of a commercially available standard Hb blood sample*

- Mix each solution thoroughly and allow to stand for at least 5 minutes.
- Read absorbance in a spectrophotometer at 540 nm against a reagent blank (cyanmeth reagent)
- Determine the y intercept (a) and slope (b) of the regression equation with absorbance as the dependent variable (y) and concentration as the independent variable (x).
- Compute Hb conc using the formula: y = a + bx ; where a = y intercept; b = slope of the line; y =absorbance or optical density (OD) and x = conc. Generate and print the standard curve.

Hemoglobin determination of collected blood samples

- Accurately pipette 20 µL of free-flowing blood directly from the finger prick (discard the first two drops of blood) or from a tube containing well-mixed anti-coagulated whole blood sample. Wipe off excess blood in the outer side of micropette with a kimwipe.
- Expel blood slowly in a tube containing cyanmethemoglobin reagent (5 mL). Rinse the micropette with the reagent in the tube until no trace of blood is visible. Mix well and allow the solution to stand for at least 5 minutes.
- Read absorbance against a reagent blank in a spectrophotometer at 540 nm wavelength. Convert absorbance to Hb conc using a standard curve.

Note: Hemoglobin tubes are always kept cold inside thermo jug containing ice whenever absorbance reading cannot be done immediately. Allow the solution to reach room temperature before absorbance reading

Quality assurance determination

Accuracy

- Determine Hb concentration of a tri-level control blood sample together with other blood samples in each assay day. Hb concentration should be within the range of the certified Hb value.

Precision

- Determine Hb concentration of internal quality control blood sample in each assay day. Hb value should be within ± 3 SD of the analyzed value.

**ICSH, 1978*

Annex 2: Evaluation procedure for identification/determination of hemoglobinopathies

EVALUATION PROCEDURE FOR HEMOGLOBINOPATHIES
by Sebia Capillarys Capillary Electrophoresis

Assay sample: Erythrocytes

Sample Assay

- Cetrifuge whole blood sample at 5,000 rpm for 5 minutes.
- Remove the overlying plasma and mix the erythrocyte pellet for 5 seconds using a vortex mixer.
- Identification, sampling, electrophoresis and production of the elctrophoregram pattern are performed using the CE instrument.
- Electrophoresis is performed in alkaline buffer, pH 9.4.
- Hemoglobins are measured at 415-nm wavelength. Electophoretograms are recorded with location of specific hemoglobins in specific zones.
- The test of the sample was repeated, being premixed with a 1:1 mixture of a normal control if HbA was not present.The presence of HbA was required for the appearance of the zone demarcations that help guideinterpretation of structural variants.Quantitative results for such a case were reported from the original sample alone, and the 1:1 mixture was used for qualitative identification only.
- Manufacturer's recommended normal ranges for healthy adults were as follows: HbA, 96.8% or more; HbF,less than 0.5%; and HbA_2, 2.2% to 3.2%.

Analysis contracted to an ISO 15189 Accredited Laboratory

Annex 3: Serum Ferritin determination by Immunoradiometric Assay (IRMA)

QUANTITATIVE DETERMINATION OF SERUM FERRITIN
by Immunoradiometric Assay *(IRMA)*

Analysts: Trained Registered Medical Technologist/Chemists

Assay sample: Serum

Test principle: Competitive protein binding assay

Reagents: **RIAKEY Ferritin IRMA Tube**
- Coated tubes (Ferritin monoclonal antibody)
- ^{125}I Tracer
- Standards (0, 5, 20, 50, 250, 500, 1000, 2000 ng/mL)
- Control serum
- Serum Diluent

Sample Assay

- Prepare and label the coated tubes (in duplicate for standards per concentration and control serum, singlefor sample(s))
- Pipette 20 µL of standards, control serum and sample(s) into each different coated tubes.
- Add carefully 300 µL of ^{125}I Tracer into all coated tubes.
- Mix thoroughly and cover the tubes with laboratory film or aluminaum foil.
- Shake in 250 – 300 RPM at room temperature (18-25 ˚C) for 1 hour.
- Aspirate the liquid from the tubes.
- Wash the tubes 2 – 3 times with 2 – 3 mL distilled water per tube.
- Count the radioactivity of the tubes for 1 min by gamma counter.

Quality assurance

Accuracy and Precision
- Bio-Rad control serum and Lypocheck Immunoassay Plus Control

Annex 4: Retinol determination by High Performance Liquid Chromatography (HPLC)

SERUM VITAMIN A
*by High Performance Liquid Chromatography (HPLC)**

Analysts: *Trained Registered Chemists*

Preparation of standards

All-*trans*-Retinol Standard

Stock solution : 1 ampule of All-*trans*-Retinol is dissolve in methanol and store in dark/amber volumetric flask.

Working solution: Stock solution is diluted with methanol until absorbance using UV-VIS spectrophotometer at 325 nm is between 0.070 – 0.075.

Retinyl Acetate, USP

Stock solution: Add absolute ethanol to 1 capsule just enough to dissolve all-*trans* Retinyl Acetate and store in amber bottle.

Working solution: Stock solution is diluted with methanol until absorbance using UV-VIS spectrophotometer at 328 nm is between 0.080 – 0.085.

Sample Preparation

- Pipette 100 µL serum/plasma into tubes and add 100 µL retinyl acetate in methanol. Mix using vortex mixer for 2 minutes.
- Add 500 µL hexane and mix. Centrifuge for 20 mins at 3000 rpm.
- Transfer the organic (top) layer to another tube. Repeat step #2 for second retinol extraction.
- Dry the retinol extract under a slow stream of nitrogen gas.

HPLC Analysis

- Re-dissolve residue in 100 µL methanol:dichloromethane (4:1) solution and mix vigorously.
- Inject/load 50 µL sample manually or by an auto-sampler.
- Solution passes through columns and retinol concentration is recorded as peak areas in the integrator.

Quality assurance determination

Accuracy

- Three levels of Standard Reference Material (SRM) (NIST 968) are analyzed with survey samples in each assay day. Retinol value should be within the acceptable range
- Participation in the VITAL-EQA program (CDC, USA)

Precision

- In-house Reference Material (IHRM) or pooled serum samples are analyzed with every ten (10) samples with retinol values within ± 3SD of the analyzed value

Precautionary Measures

- Analysis should be conducted in a room with subdued light.
- Room temperature and humidity should be within acceptable range
- Use of non-powdered gloves and mask during collection and analysis

CDC, 1986

Annex 5: Serum 25-hydroxyvitamin D [(25-OH(D)] determination by the Electro-chemiluminescence binding assay (ECLIA)

DETERMINATION OF TOTAL SERUMVITAMIN D (25-OH)
by *Electro-chemiluminescence binding assay (ECLIA)*

Assay sample: Serum

Test principle: Competitive protein binding assay

Sample Assay

- Incubate the 15 µL sample with a pretreatment reagent for 9 minutes, thereby, the natural VDBP in the sampleisdenatured to release the bound vitamin D (25-OH). .
- Incubate the sample further with a recombinant ruthenium-labeled VDBP to form a complex of vitamin D(25-OH) and the ruthenylated-VDBP.
- Add biotinylated vitamin D (25-OH), a complex consisting of the ruthenium-labeled VDBP, to form biotinylated vitamin D (25-OH). The entire complex becomes bound to the solid phase (by the interaction of biotin and streptavidin-coated microparticles which are captured on the surface of the elecrode).
- Apply voltage to the electrode to induce chemiluminescent emission which is measured by a photomultiplier. Results are determined via an instrument-specific calibration curve which is generated by 2-point calibration and a calibration master curve provided via the reagent barcode

Quality assurance determination

Accuracy
- Vitamin D total CalSet

Precision
- PreciControl Varia

Analysis contracted to an ISO 15189 Accredited Laboratory

Annex 6: Zinc determination by Atomic Absorption Spectroscopy

Serum Zinc

*by Atomic Absorption Spectroscopy(AAS)**

Analysts: Trained Chemists

Preparation of reagents and zinc standard solution:

0.05 N Hydrochloric Acid(HCl)–Pipet 4.17 mL of HCL (18 N) into a 1 L volumetric flask with approximately 500 mL nano pure water. Shake gently and dilute to the mark with nano pure water.

6% n-butanol in 0.05 Hydrochloric acid (Sample Diluent) – Measure 60 mL of n-butanol and deliver into 1L volumetric flask. Dilute to the mark with 0.05N HCl and mix gently.

5% Glycerol in sample diluent (Matrix matched solution) – Measure 25 mL and deliver into a 500 mL volumetric flask. Dilute to the mark with (SD) and mix gently.

Stock Zinc Standard Solution- Pipet 1 mL of 1000 ppm zinc standard in a 100 mL volumetric flask and volume to the mark with matrix-matched solution (MMS). Shake gently.

Working Standard Solution- Deliver specified volume of stock standard solution in corresponding volumetric flask as shown in Table 1. Dilute to volume with MMS and mix by inverting the flask several times.

Volume requirement of zinc stock standard at different total volume preparation

Standard conc (ppm)	Volume of Stock Standard Solution, µL		
	100 mL	50 mL	25 mL
0.025	250	125	62.5
0.050	500	250	125
0.100	1000	500	250
0.200	2000	1000	500
0.300	3000	1500	750
0.400	4000	2000	1000
0.500	5000	2500	1250

.

Sample Preparation:

Carefully pipette serum sample 100 µL in properly labeled tube.

AAS Analysis:

1. Turn-on UPS, hood, AAS and external computer. Warm up AAS for 30 minutes.
2. Align the light path using the alignment card and optimize the lamp.
3. Add 2 mL SD to each test tube with100 µL serum/SRM/in-house control sample. Vortex and read in the AAS

Quality Assurance Determination:

Accuracy

Trace elements Standard Reference Material (SRM) (NIST 1598a) and Seronorm Level 2 were analyzed with survey samples in each assay day. Zinc value should be within the acceptable range.

Precision

In-house Reference Material (IHRM) or pooled serum samples are analyzed with every ten (10) samples with zinc values within ± 3SD of the analyzed value

Precautionary measures

- The working environment should be dust-free and all glasswares should be acid washed with 20% nitric acid.
- Serum were separated from red blood cells within 2 hours after blood extraction. Hemolyzed serum samples were not analyzed.
- Working standards should be freshly prepared. Acid preparation should be strictly done inside a fumehood.
- .Use of non-powdered gloves and mask is a must during sample collection and analysis.

Smith et al., 1979

Annex 7: UIE determination by the acid digestion method

URINARY IODINE

by Acid Digestion/Colorimetric Method[1]

Analysts: *Trained Registered Chemists*

Sample Collection and Storage

- Collect mid-stream casual urine samples in clean labeled polystyrene bottle.
- Store samples inside ice chest with wet ice while in the field and in-transit to FNRI laboratory where they are immediately transferred to freezer until analyzed.

Sample Assay

- Pipette 250 µL urine sample and add 1 mL Ammonium Persulfate.
- Digest at 100° C and cool to room temperature.
- Add 2.5 mL Arsenous Acid and 300 µL Ceric Ammonium Sulfate.
- Read absorbance in spectrophotometer (420 nm) at 15 seconds interval.

Quality assurance determination

Accuracy

- Standard Reference Material **(**SRM) are analyzed with samples at the start and end of each assay. Urinary iodine value should be within the acceptable range.
- Participation in Ensuring the Quality of Urinary Iodine Procedures (EQUIP) Program of CDC, USA.

Precision

- Tri-level (high, normal and low) in-house pooled urine samples are analyzed with samples in each assay day with urinary iodine values within ± 3SD of the analyzed value.

Precautionary measures

- The working environment should be dust-free and all glasswares should be acid washed with 20% nitric acid.
- Working standards should be freshly prepared. Acid preparation should be strictly done inside the fume hood.
- Use of non-powdered gloves and mask is a must during sample collection and analysis.

[1] *Dunn et al., 1993*

Annex 8. Biochemical Survey Forms (Booklet 8)

All data obtained are CONFIDENTIAL and cannot be used for taxation, investigation or enforcement purposes.

NSCB Approval No.:
Expires:

REPUBLIC OF THE PHILIPPINES
FOOD AND NUTRITION RESEARCH INSTITUTE
DEPARTMENT OF SCIENCE AND TECHNOLOGY
MANILA

THE 2013 NATIONAL NUTRITION SURVEY

BOOKLET 8 - BIOCHEMICAL INFORMATION, ALL MEMBERS

Geographic Identification Codes

Region _____ ☐☐
Province _____ ☐☐
Mun/City _____ ☐☐
Bgy _____ ☐☐☐
EA _____ ☐☐☐
HCN _____ ☐☐☐☐

Design Codes

Replicate _____ ☐
Stratum _____ ☐☐☐☐☐
PSU No. _____ ☐☐☐☐☐
Rotation Grp. _____ ☐☐
SHSN _____ ☐☐☐☐☐

Household Identification

Name of Subject: _____
Name of Household Head: _____
Address: _____
Contact Number: _____

CERTIFICATION

I hereby certify that the data gathered in this questionnaire were obtained/edited/reviewed by me personally and in accordance with the instructions.

_____	_____	_____	_____
		Signature Over Printed Name of Team Leader	
_____	_____	_____	_____
		Signature Over Printed Name of Office Editor	
_____	_____	_____	_____
Signature(s) Over Printed Name(s) of Researcher(s)	Date Signed	Signature Over Printed Name of Data Encoder	Date Signed

8thNNS FORM 8.1 – BIOCHEMICAL INFORMATIONOF ALL MEMBERS

AREA CODE | | | | | | | | | |
Copy from NNS Form 1.1

HH CONTROL NO. | | | |
Copy from NNS Form 1.1

1	2	3	4			5		6	7	8	8	
MEM NO	NAME	SAMPCODE	DBIRTH			AGE		SEX	CSC	AGE_M	PSC	
MEMBER NO.	Copy the **Names** of all the subjects from NNS Form 1.1. Write surname first.	BIOCHEM SAMPLE CODE	Copy from NNS FORM 1.1									
			MO	DA	YEAR	YRS	MOS	SEX	CSC	Age of Menarche	Physiological Status	CODE

AGE: Age of members; years completed as of last birthday serve as code. For children less than 6 years of age, express the age in months (i.e. 6-71). Age of children over 6 yrs but <7 yrs is coded as 6.1

PHYSIOLOGICAL STATUS (PSC): This applies to all female members, 13 yrs and above.
0 – Female, 13 yrs and above; non-pregnant, non-lactating
1 – Pregnant 1st Trimester (01-13 wks AOG)
2 – Pregnant 2nd Trimester (14-27 wks AOG)
3 – Pregnant 3rd Trimester (28-40 wks AOG)
4 – Lactating 1st 6 mos
5 – Lactating Next 6 mos
6 – Lactating Over 1 yr
7 – 1st Trimester Pregnant at the same time Lactating
8 – 2nd and 3rd Trimester Pregnant at the same time Lactating
9 – Children < 13 yrs and males 13 yrs and above

2

FNRI-DOST
8th NNS

8thNNS FORM 8.2 – BIOCHEMICAL INDICES FOR ALL MEMBERS

AREA CODE | | | | | | | | | | |
Copy from NNS Form 1.1

HH CONTROL NO. | | | |
Copy from NNS Form 1.1

1	2	3							4				
		BIOCHEMICAL INDICES											
		WHOLE BLOOD							SERUM				
MEMBER NO.	BIOCHEM SAMPLE CODE	HEMOGLOBIN g/dL	HEMATOCRIT vol %	RBC count	MCV fl/cell	MCH pg/cell	MCHC g/dL	WBC count/c.mm	VITAMIN A mcg/dL	ZINC mcg/dL	FERRITIN ng/mL	VITAMIN D ng/mL	FOLATE ng/mL

REMARKS:

FNRI-DOST 8th NNS

3

3

REFERENCE DATE MO | DA | YR

RESEARCHER: ____________ EDITED BY: ____________

1	2	5	6			7		8
MEM NO	SAMPCODE	RBC	BRESMILK			URINE		REMARKS
MEMBER NO.	BIOCHEM SAMPLE CODE	FOLATE ng/mL	IRON mg/L	ZINC mg/L	CALCIUM mg/L	IODINE mcg/L	CALCIUM mg	REMARKS

4

Annex 9: Ethics approval for Thalassemia study

Form 7

FNRI Institutional Ethics Review Committee

July 30, 2013

FOR : Dr. Imelda A. Agdeppa

THRU : The Secretariat, FNRI Institutional Ethics Review Committee

SUBJECT : Final Action on Project Proposal

Please be informed that your Project proposal entitled "Screening for Iron Deficiency Anemia, Thalassemia and Other Hemoglobinopathies in the Philippines: A Component of the 8th NNS" as been approved by the FNRI Institutional Ethics Review Committee with FIERC Registry No. 2013-06-04-0008-2.

GEMILIANO D.L. ALIGUI, M.D., M.P.H.
FIERC Chairperson

Noted:

MARIO V. CAPANZANA, Ph.D.
Director

CERTIFIED TRUE COPY

AUG 0 6 2013

Annex 10: Ethics approval for Vitamin D study

Form 7

FNRI Institutional Ethics Review Committee

April 25, 2014

FOR : Dr. Imelda A. Agdeppa

THRU : The Secretariat, FNRI Institutional Ethics Review Committee

SUBJECT : Final Action on Project Proposal

Please be informed that your Project proposal entitled "Vitamin D Status of Filipino Adults in the National Capital Region and selected provinces in Mindanao and Visayas, Philippines: 8th National Nutrition Survey" has been approved by the FNRI Institutional Ethics Review Committee with FIERC Registry No. 2013-08-08-0009-2.

GEMILIANO D.L. ALIGUI, M.D., M.P.H.
FIERC Chairperson

Noted:

MARIO V. CAPANZANA, Ph.D.
Director

Annex 11: Consent form for Thalassemia study (English)

FOODAND NUTRITION RESEARCH INSTITUTE

Department of Science and Technology
Gen. Santos Ave., Bicutan, Taguig, Metro Manila, Philippines
Tel. Nos. 837-2934; 837-2071 to 82; Fax No. (632) 837-3164

Adult Consent Form

Prevalence of Iron Deficiency Anemia and Thalassemia in the National Capital Region, Philippines: Implications on Policies on Anemia

Name of Respondent: _____

Address: _____

Household Number: _____

I voluntarily agree to be included as a participant in the study entitled "**Screening for Iron Deficiency Anemia, Thalassemia and Other Hemoglobinopathies in the Philippines: Component Project of the 8th National Nuntiriton Survey**" to be conducted by the Food and Nutrition Research Institute of the Department of Science and Technology. I fully understood that the objective of the project is "to determine the prevalence of iron deficiency anemia, thalassemia and the different hemoglobinopathies among Filipinos".

As participant of the study, I also freely give my permission to undergo the data collection procedures which include the measurement of my height and weight, interview on health and nutrition related information, intake of supplements and food intake, and collection of about 5 cc of blood to determine my hemoglobin and serum ferritin level. I know and consent that these procedures are necessary to determine the prevalence of iron deficiency anemia and thalassemia among Filipinos. Genetic analysis for determination confirmation of thalassemia will also be conducted in futures studies. I also know that blood extraction will be done by a registered Medical Technologist. I understand that the blood extraction will not cause undue pain or harm. Safety precautions, such as use of sterile disposable syringes, will be observed. I will be provided with results of tests, and advised on what to inform my doctor, so that proper treatment can be given if I am found to be thalassemic. I may also contact the Project Leader for more details of the study. For inquiries regarding my rights as a participant of the study, I can contact Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Ethics Review Committee (FIERC) at telephone number (02) 8372071 local 2297. I understand that my participation in this study is voluntary and that I may discontinue participation at any time during the conduct of the study without penalty.

Be it known that the foregoing was executed voluntarily and without fear or reprisal of anyone after having fully understood the objectives of the study.

In witness hereof, I hereto set my hand this _____ day of _____ 2013 at _____.

Witness:

_____ _____

Signature of Participant over printed Name Signature of FNRI Representative over printed name

Project Leader

IMELDA ANGELES-AGDEPPA, Ph.D.
Assistant Scientist
Food and Nutrition Research Institute-DOST
Gen. Santos Ave., Bicutan, Taguig City
Tel. No.: (02)8372071 Local 2280
E-mail Address: iaa@fnri.dost.gov.ph

Consent form for Thalassemia Study (Tagalog)

FOODAND NUTRITION RESEARCH INSTITUTE

Department of Science and Technology
Gen. Santos Ave., Bicutan, Taguig, Metro Manila, Philippines
Tel. Nos. 837-2934; 837-2071 to 82; Fax No. (632) 837-3164

Adult Consent Form

Prevalence of Iron Deficiency Anemia and Thalassemia in the National Capital Region, Philippines: Implications on Policies on Anemia

Name of Respondent: _____

Address: _____

Household Number: _____

Ako ay kusang-loob na sumasang-ayon na makasama sa program na tinaguriang "**Screening for Iron Deficiency Anemia, Thalassemia and Other Hemoglobinopathies in the Philippines: Component Project of the 8th National Nuntiriton Survey**" na isasagawa ng Food and Nutrition Research Institute ng Department of Science and Technology (FNRI-DOST). Lubos kong nauunawaan ang layunin ng pananliksik na ay upang malaman ang porsyento ng mga Pilipino na may anemia.

Bilang kasapi ng pagsusuri, kusang-loob ko iginagawad ang aking pahintulot na masukatan ng taas at timbang, pagkuha ng impormasyon pagkuha ng impormasyon tungkol sa mga kinain niya, pagkuha ng dugo (less than 5 cc) para malaman kung sila ay anemic, iron deficient o thalassemic. Para masiguro kng ako ay thalassemic, gagawan din ng "genetic analysis" ang aking dugo. Batid ko na ang mga gagawing pagsusuri ay libre. Maaari ko din kapanayamin ang Project Leader para sa iba pang detalye ng pagsusuri. Bibigyan ako ng resulta ng mga pagsusuri para mabigyan ako ng tamang gamut kung malaman na ako ay may thalassemia.Kung mayroon akong katanungan tungkol sa aking karapatan bilang kasali sa programa, maaari kong tawagan si Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Ethics Review Committee (FIERC) sa telepono bilang (02) 8372071 local 2297. Nauunawaan ko na ang pagsapi ko sa programa ay kusang-loob at maaari akong tumiwalag ano mang oras na naisin ko ng walang multa o kaparusahan.

Ang pahintulot na ito ay Malaya kong iginagawad ng walang pananakot ninuman matapos kong lubos na maunawaan ang mga layunin ng programa.

Bilang patunay ng aking/aming pagsang-ayon, aking nilagdaan ang kasulatang ito ngayong ika- _____ ng _____ 2013 at _____.

Witness:

_____ _____

Pangalan at Lagda ng Participant Pangalan at Lagda ng Kumakatawan sa FNRI

Project Leader:

IMELDA ANGELES-AGDEPPA, Ph.D.
Assistant Scientist
Food and Nutrition Research Institute-DOST
Gen. Santos Ave., Bicutan, Taguig City
Tel. No.: (02)8372071 Local 2280
E-mail Address: iaa@fnri.dost.gov.ph

FOODAND NUTRITION RESEARCH INSTITUTE

Department of Science and Technology
Gen. Santos Ave., Bicutan, Taguig, Metro Manila, Philippines
Tel. Nos. 837-2934; 837-2071 to 82; Fax No. (632) 837-3164

Assent forms
Prevalence of Iron Deficiency Anemia and Thalassemia in the National Capital Region, Philippines: Implications on Policies on Anemia

Dear Parents:

The Food and Nutrition Research Institute of the Department of Science and Technology (FNRI-DOST) is conducting a study **"Prevalence of Iron Deficiency Anemia and Thalassemia in the National Capital Region, Philippines: Implications on Anemia Policies"**. The objective of the study is "to determine the prevalence of iron deficiency anemia and the different hemoglobinopathies among Filipinos". The prevalence of anemia among Filipinos has remained persistently high as shown in previous national nutrition surveys. The underlying cause of anemia has not been fully determined. It may be caused by low iron intake and infection, among others. However, this could also be due to thalassemia. This is a condition which can be misdiagnosed as iron deficiency anemia. If misdiagnosed, and iron supplementation is advised, this would cause iron overload.

Should you allow your child to participate in the survey, we will need to obtain your child's height and weight, health and nutrition related information, intake of vitamin supplements and food intake. Apart from this, about 5 cc of blood will be collected by a registered Medical Technologist, to determine the hemoglobin level of your child. This is to test whether your child is anemic or not. The rest of the blood samples will be used to conduct serum ferritin analysis and determine if he/she is iron deficient. Genetic analysis for determination confirmation of thalassemia will also be conducted in futures studies. Please be assured that the blood extraction will not cause undue pain or harm. Safety precautions, such as use of sterile disposable syringes, will be observed. Please be assured also, that information obtained through the study will remain confidential and will be used only for the purpose indicated in the study. Also, participation in this study is voluntary and that your child may discontinue participation at any time during the conduct of the study without penalty.

We have attached, for your signature, the Guardian's Consent Form signifying your permission to allow your child to be included as a participant in the study.

Thank you.

MARIO V. CAPANZANA, Ph.D.
Director

Name of Child: _____
Barangay, Municipality : _____
Province: _____

PARENT'S CONSENT FORM

I voluntarily agree for my child to be included as a participant in the study entitled **"Prevalence of Iron Deficiency Anemia and Thalassemia in the National Capital Region, Philippines: Implications on Policies on Anemia"**. The objective of the study is "to determine the prevalence of iron deficiency anemia and the different hemoglobinopathies among Filipinos".

I freely give my permission for my child to undergo the data collection procedures which include the measurement of height and weight, interview on health and nutrition related information, intake of supplements and food intake. Also, I give my permission for my child to submit him/her self for blood collection for hemoglobin and serum ferritin testing. Genetic analysis for determination confirmation of thalassemia will also be conducted in futures studies. I know and consent that these procedures are necessary to determine iron status of my child and all tests conducted will be free. I also know that blood extraction will be done by a registered Medical Technologist. I understand that the blood extraction will not cause undue pain or harm. Safety precautions, such as use of sterile disposable syringes, will be observed. I may also contact the Project Leader for more details of the study. You will be given results of tests, so that if found to be thalassemic, your doctorcan give proper treatment to your child. For inquiries regarding my child's right as a participant of the program, we can contact Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Ethics Review Committee (FIERC) at telephone number (02)

8372071 local 2297. I understand that participation in this study is voluntary and that my child may discontinue participation at any time during the conduct of the study without penalty.

Be it known that the foregoing was executed voluntarily and without fear or reprisal of anyone after having fully understood the objectives of the study.

In witness hereof, I hereto set my hand this _____ day of _____ 2013 at _____.

_____ Father's Name and Signature

_____ Mother's Name and Signature

Witness:

_____ Signature of FNRI Representative over printed name

Project Leader:

IMELDA ANGELES-AGDEPPA, Ph.D.
Assistant Scientist
Food and Nutrition Research Institute-DOST
Gen. Santos Ave., Bicutan, Taguig City
Tel. No.: (02)8372071 Local 2280
E-mail Address: iaa@fnri.dost.gov.ph

FOODAND NUTRITION RESEARCH INSTITUTE
Department of Science and Technology
Gen. Santos Ave., Bicutan, Taguig, Metro Manila, Philippines
Tel. Nos. 837-2934; 837-2071 to 82; Fax No. (632) 837-3164

Prevalence of Iron Deficiency Anemia and Thalassemia in the National Capital Region, Philippines: Implications on Policies on Anemia

Mga Magulang:

Ang Food and Nutrition Research Institute ng Department of Science and Technology (FNRI-DOST) ay nagsasagawa ng pagaaral tinaguriang "**Screening for Iron Deficiency Anemia, Thalassemia and Other Hemoglobinopathies in the Philippines: Component Project of the 8th National Nuntiriton Survey**". Ang layunin ng pag aaral na ito ay upang malaman kung ilan sa mga Pilipino ang may iron deficiency anemia at thalasemia. Ayun sa mga nakaraan na survey, mataas ang porsyento ng mga Pilipino na may anemia. Ang sanhi nito ay hindi pa lubos na alam, pwede ito sa kadahilanan na kulang ng iron sa pagkain o kaya dahil sa infection. Maliban dito pwede dn mging sanhi ang thalassemia.

Kung inyong bibigyang pahintulot ang inyong anak na lumahok sa survey, ang mga bata ay kailangang dumaan sa pagsusuri gaya ng pagkuha ng taas at timbang ganoon din and pag kuha ng impormasyon tungkol sa mga kinain niya. Bilang kalahok, kukuhanan din ang mga bata ng dugo (less than 5 cc) para malaman kung sila ay anemic, iron deficient thalassemic. Makakaasa po kayo na ang mga impormasyong makakalap ay mananatiling lihim at gagamitin lamang para sa layon ng pananaliksik na ito. Ang partipasyon sa panaliksik na ito ay boluntaryo at puwedeng huminto sa pagsali anumang oras na walang multa o kaparusahan.

Kung kayo po ay sumasang-ayon sa mga nabanggit ay maaari lamang na lagdaan ang PAGPAPAHAYAG NG PAGSANG-AYON upang mapabilang ang inyong anak sa pag-aaral.

Maraming salamat po.

MARIO V. CAPANZANA, Ph.D.
Director

Pangalan ng bata: _____
Barangay / Municipality :_____
Province: _____

PAGPAPAHAYAG NG PAGSANG-AYON

Ako ay kusang-loob na sumasang-ayon na maging bahagi ang aking anak sa gagawing pananaliksik na tinaguriang "**Screening for Iron Deficiency Anemia, Thalassemia and Other Hemoglobinopathies in the Philippines: Component Project of the 8th National Nuntiriton Survey***" na isinasagawa ng Food and Nutrition and Research Institute ng Department of Science and Technology*. Pagkatapos ng malinaw na pagbibigay ng kaukulang impormasyon sa pag-aaral na ito, lubos kong nauunawaan na ang layunin ng pananliksik ay upang malaman ang porsyento ng mga Pilipino na may anemia at thalassemia.

Kusang-loob ko ding iginagawad ang aking pahintulot na masukatan ng taas at timbang, pagkuha ng impormasyon sa kinakain at iba pang impormasyong pangkalusugan ang aking anak. Sumasang-ayon din ako sa pagkuha ng konting dugo (less than 5 cc) para malaman kung siya ay anemic, iron deficient o thalassemic. Batid ko na ang mga gagawing pagsusuri ay libre. Maaari ko din kapanayamin ang Project Leader para sa iba pang detalye ng pagsusuri. Batid ko rin na registered Medical Technologist ang mg-extract ng dugo at ito ay hindi mgdudulot ng sakit at, ang mga kagamitan sa pagkuha ng dugo ay "sterile at disposable". Bibiyan kami ng results ng mga pagsusuri para malaman kng ang anak ko ay may thalassemia at mabigyan ng tamang gamot. Kung mayroon akong katanungan tungkol sa karapatan ng aking anak bilang kasali sa pananaliksik na ito, maaari kong tawagan si Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Ethics Review Committee (FIERC) sa telepono

bilang (02) 8372071 local 2297. Batid ko na ang partipasyon sa pananaliksik na ito ay boluntaryo at puwedeng huminto sa pagsali anumang oras na naisin ko ng walang multa o kaparusahan.

Ang pahintulot na ito ay malaya kong iginagawad ng walang pananakot ninuman matapos kong lubos na maunawaan ang mga layunin ng programa.

Bilang patunay ng aking/aming pagsang-ayon, aking nilagdaan ang kasulatang ito ngayong ika- _____ ng _____ 2013 at _____

_____ _____ Pangalan at Lagda ng

Ama Pangalan at Lagda ng Ina

Saksi:

_____

Pangalan at Lagda ng Kumakatawan sa FNRI

Taga-Pamahala ng Proyekto:

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Pangalan : _____
Barangay / Municipality :_____
Province: _____

PAGPAPAHAYAG NG PAGSANG-AYON

Ako ay kusang-loob na sumasang-ayon na makasama sa program na tinaguriang "**Screening for Iron Deficiency Anemia, Thalassemia and Other Hemoglobinopathies in the Philippines: Component Project of the 8th National Nuntiriton Survey**" na isasagawa ng Food and Nutrition Research Institute ng Department of Science and Technology (FNRI-DOST). Lubos kong nauunawaan ang layunin ng pananliksik na ay upang malaman ang porsyento ng mga Pilipino na may anemia.

Bilang kasapi ng pagsusuri, kusang-loob ko iginagawad ang aking pahintulot na masukatan ng taas at timbang, pagkuha ng impormasyon pagkuha ng impormasyon tungkol sa mga kinain niya, pagkuha ng dugo (less than 5 cc) para malaman kung sila ay anemic, iron deficient o thalassemic. Para masiguro kng ako ay thalassemic, gagawan din ng "genetic analysis" ang aking dugo. Batid ko na ang mga gagawing pagsusuri ay libre. Maaari ko din kapanayamin ang Project Leader para sa iba pang detalye ng pagsusuri. Bibigyan ako ng resulta ng mga pagsusuri para mabigyan ako ng tamang gamut kung malaman na ako ay may thalassemia.Kung mayroon akong katanungan tungkol sa aking karapatan bilang kasali sa programa, maaari kong tawagan si Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Ethics Review Committee (FIERC) sa telepono bilang (02) 8372071 local 2297. Nauunawaan ko na ang pagsapi ko sa programa ay kusang-loob at maaari akong tumiwalag ano mang oras na naisin ko ng walang multa o kaparusahan.

Ang pahintulot na ito ay Malaya kong iginagawad ng walang pananakot ninuman matapos kong lubos na maunawaan ang mga layunin ng programa.

Bilang patunay ng aking/aming pagsang-ayon, aking nilagdaan ang kasulatang ito ngayong ika- _____ ng _____ 2013 at _____.

Witness:

_____ _____
Pangalan at Lagda ng Bata Pangalan at Lagda ng Kumakatawan sa FNRI

Project Leader:

IMELDA ANGELES-AGDEPPA, Ph.D.
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Annex 12: Consent form for Vitamin D study

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Consent Form

Vitamin D Status of Filipino Adults in the National Capital Region and select provinces in Visayas and Mindanao Philippines: 8th National Nutrition Survey

Name of Respondent: _____

Address: _____

Household Number: _____

I voluntarily agree to be a participant of the project "Vitamin D Status of Filipino Adults in the National Capital Region and select provinces of Visayas and Mindanao, Philippines: 8th National Nutrition Survey". The objective of the study is to determine the vitamin D status and prevalence of vitamin D deficiency of Filipino adults aged 19 years and older, in the National Capital Region and select provinces of Visayas and Mindanao. This survey will be conducted in about 5,000 participants. To date no population studies have been conducted among Filipinos.

(Ako ay kusang loob na sumasang-ayon na makasama sa projecto tinaguriang "Vitamin D Status of Filipino Adults in the National Capital Region and select province of Visayas and Mindanao, Philippines: 8th National Nutrition Survey". Ang layunin ng pag aaral na ito ay upang malaman kung may kakulangan sa Vitamin D ang mga Filipino may edad na 19 years at pataas sa National Capital Region at piling probinsya sa Visayas at Mindanao. Humigit kumulang na 5,000 na katao ang aanyayahan na lumahok sa pagsusuri. Wala pang pag aaral na naisagawa tungkol sa kakulangan sa Vitamin D sa mga Filipinos.)

I was informed that about 7mL of blood will be extracted for determination of vitamin D levels by registered Medical Technologist. I understand that the blood extraction will not cause pain or harm. Safety precautions, such as use of sterile disposable syringes and needles, will be observed. I fully understand that the collected blood samples will only be used for the purposes indicated in the study and results will remain confidential. No samples will be taken out of the country. Any remaining samples will be disposed off properly.

(Bilang kalahok, napabatid na sa akin sa pagkuha ng 7mL na dugo para sa pagsusuri vitamin D.Batid ko rin na registered Medical Technologist ang mg-extract ng dugo at ito ay hindi mgdudulot ng sakit. Ang mga kagamitan sa pagkuha ng dugo ay "sterile at disposable". Lubos kong nauunawaan na ang dugong kokolektahin mula sa akin ay gagamitin lamang ng naayon sa mga layunin ng pag-aaral na ito at mananatiling lihim. Hindi rin ilalabas sa bansa ang dugo na nakuha sa akin. Ano mang matitira o hindi magagamit sa mga pagsusuri na gagawin ay itatapon ng wasto.)

I was also informed that the tests to be conducted will be free. I understand that I will be provided with results of the test. Result can be showed to my doctor so that proper medication will be initiated if I am found to be vitamin D deficient. I also understand that I will not be paid or given any incentive in participating in this study.

(*Napabatid din sa akin na ang pag susuri na ito ay libre. Bibigyan ako ng resulta sa pag susuri sa akin at ito ay pwede kong ipakita sa aking Doktor para mabigyan ng wastong lunas kung ako ay may kakulangan sa Vitamin D. Nababatid ko na wala akong matatangap na pabuya or "incentive" sa paglahok sa pagsusuri na ito.)*

For inquiries regarding my right as a participant of the program, I can contact Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Review Committee (FIERC) at telephone number (02) 8372071 loc 2297. I understand that participation in this study is voluntary and I may discontinue participation at any time during the conduct of the study without penalty.
(Kung mayroon akong katanungan tungkol sa karapatan ko bilang kasali s pananaliksik na ito, maari kong tawagan si Dr. Gemiliano DL Aligui, Chair, FNRI Institutional Ethics and Review Committee (FIERC) sa telepono bilang (02) 8372071 loc 2297). *Batid ko na ang participasyon sa pananaliksik na ito ay boluntaryo at puwedeng huminto sa pagsali anumang oras na naisin ko ng walang multa o kaparusahan.)*

Being informed on the research protocol of the 8th National Nutrition Survey (NNS), I of legal age, affix my signature as a sign that I voluntarily join and willingly undergo the required blood extraction.

(Ngayong naipabatid nang lubos ang mga paraan ng pananaliksik ng "8th National Nutrition Survey", ako na nasa tamang edad, ay lumalagda bilang sinyales na ako ay kusang loob na lumalahok at malayang sumasang-ayon na magpasailalim sa nararapat na pagkuha ng dugo.)

In witness hereof, I set my hand to take part in the collection procedure of the survey.

(Bilang saksi, ako ay lumalagda bilang pakikiisa sa pamamaraan ng pagkalap ng surbey na ito.)

Participant:

Signed in the presence of:
Nilagdaan sa harap ni:

_____
Signature of Participant over printed name
(Lagda ng Participant)

_____
Signature of FNRI Representative
over printed name
(Lagda ng Kumakatawan sa FNRI)
Date:_____

In case there will be untoward or negative side effects that is related to the study, please contact the Study Leader.

(*Kung sakaling mayroong hindi inaasahang insidente o negatibong nararamdaman na may kinalaman sa pananaliksik,, maari pong tawagan ang lider ng grupo.*

Study Leader:
Imelda A. Agdeppa , Ph.D.,
Assistant Scientist
Tel Number 837-2934/839-1843 (Telefax)
Food and Nutrition Research Institute
Department of Science and Technology

8. List of Biochemical Survey Staff

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