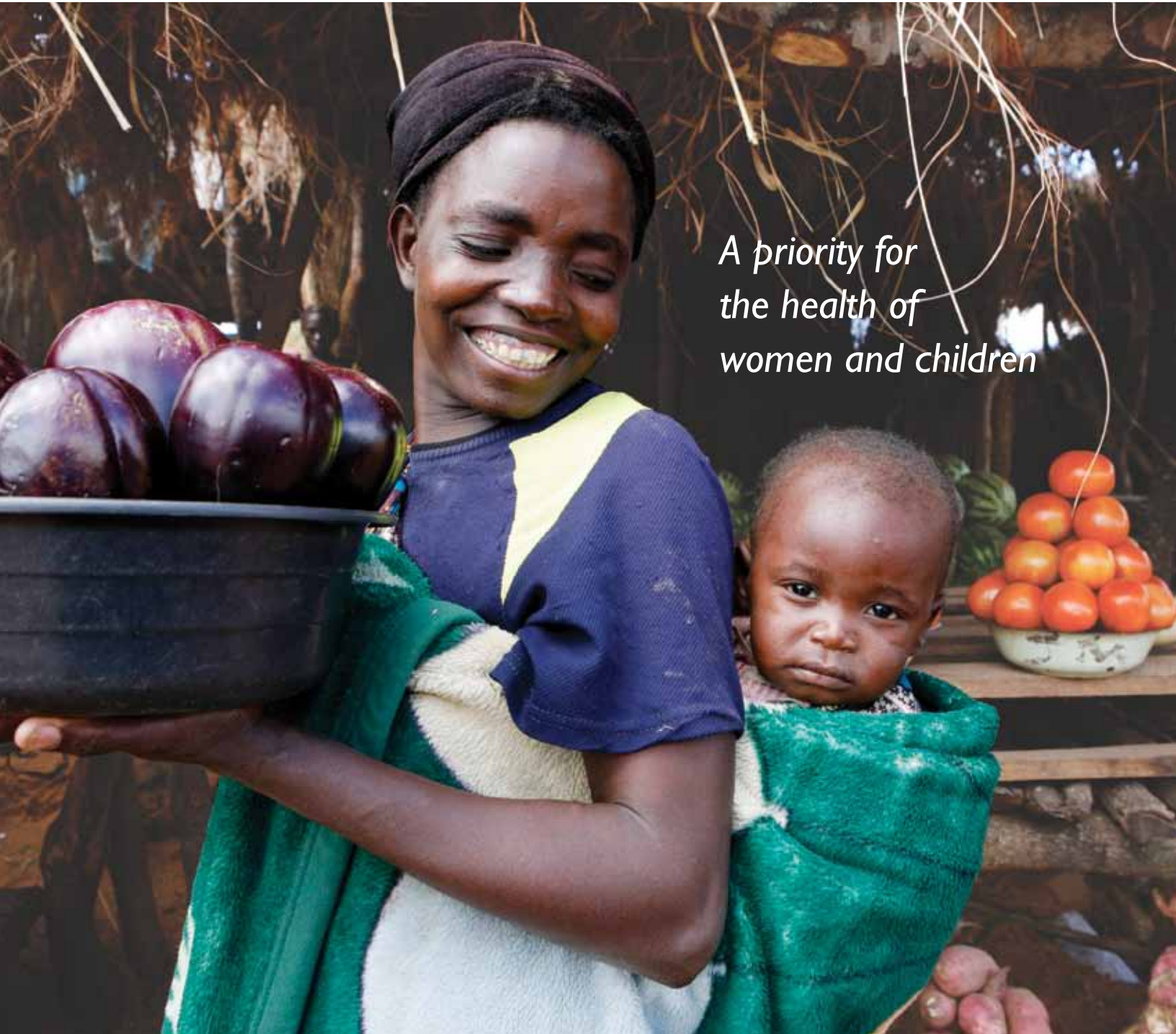




**USAID**  
FROM THE AMERICAN PEOPLE



*A priority for  
the health of  
women and children*



## Are We Making Progress on Reducing Anemia in Women?

Cross-country Comparison of Anemia Prevalence, Reach, and  
Use of Antenatal Care and Anemia Reduction Interventions



# Are We Making Progress on Reducing Anemia in Women?

Cross-country Comparison of Anemia Prevalence, Reach, and Use of Antenatal Care and Anemia Reduction Interventions

*June 2011*

Rolf DW Klemm, A. Elisabeth Sommerfelt, Alfred Boyo, Corazon Barba, Prakash Kotecha, Mona Steffen, and Nadra Franklin

A2Z: The USAID Micronutrient and Child Blindness Project

**Cover Page: AED File Photo**

Contact Information:

A2Z: The USAID Micronutrient and Child Blindness Project

AED

1825 Connecticut Ave., NW

Washington, DC 20009 USA

Email: [A2Z\\_info@aed.org](mailto:A2Z_info@aed.org)

Website: <http://www.a2zproject.org/>

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of Cooperative Agreement No. GHS-A-00-05-00012-00. The contents are the responsibility of AED and do not necessarily reflect the views of USAID or the United States Government

From the A2Z Project we wish to especially thank Elizabeth Deal and Janna Porter for assistance with creating tables found in the appendix; Omar Dary, Zo Rambeloso, Lidan Du, and Laura Seckel from A2Z for providing thoughtful comments on drafts of the monograph; Joan Whelan, Renuka Bery, Morgan Hillenbrand, and Cynthia Arciaga for their review and copy editing; and Jill Vitick for the lay-out and graphics. Additional appreciation goes to colleagues at USAID, especially Jessica Tilahun, Mary Ellen Stanton, and Jim Shelton who reviewed the document and provided helpful comments.

Recommended citation: Klemm R, Sommerfelt AE, Boyo A, Barba C, Kotecha P, Steffen M, and Franklin N. Are We Making Progress on Reducing Anemia in Women? Cross-country Comparison of Anemia Prevalence, Reach, and Use of Antenatal Care and Anemia Reduction Interventions. AED, June 2011.

# Table of Contents

Tables .....	ii
Figures .....	iii
Acronyms .....	iv
Glossary of Terms .....	v
Key Messages .....	vi
Actions Needed .....	ix
Overview .....	1
1.1 What is Anemia? .....	1
1.2 The Challenge of Maternal Anemia .....	1
1.3 Consequences: What is at Stake? .....	2
1.4 What Causes Anemia in Women? .....	3
1.5 Effective Interventions to Reduce Maternal Anemia .....	5
Purpose and Methods .....	9
2.1 Purpose .....	9
2.2 Methods .....	9
Findings .....	15
3.1 Anemia in Women: Where We Stand .....	15
3.2 Changes over Five Years in Anemia Prevalence in Women .....	17
3.3 Antenatal Care as a Service Delivery Platform for Reaching Pregnant Women .....	18
3.4 Iron Supplementation in Pregnancy .....	23
3.5 Correlation between ANC Use and Iron Supplementation in Pregnancy .....	27
3.6 Prevention and Treatment of Malaria during Pregnancy .....	28
3.7 De-worming Medication during Pregnancy .....	31
Examples of Preliminary Policy and Program Assessments for Maternal Anemia Prevention and Control in Three A2Z Focus-Countries: Uganda, India, and the Philippines .....	33
4.1 The A2Z Project .....	33
4.2 Uganda .....	36
4.3 India .....	38
4.4 Philippines .....	41

Conclusions and Recommended Actions .....	45
5.1 Summary.....	45
5.2 Actions Needed.....	48
References.....	50
Appendices .....	53
Appendix 1. Anemia prevalence and mean hemoglobin (SD) among pregnant women .....	54
Appendix 2. Anemia prevalence and mean hemoglobin (SD) among non-pregnant women .....	55
Appendix 3. Changes in anemia prevalence among pregnant women over two consecutive DHS surveys .....	56
Appendix 4. Changes in anemia prevalence among non-pregnant women over two consecutive DHS surveys in selected countries.....	57
Appendix 5. Antenatal care (ANC) participation, frequency, and timing.....	58
Appendix 6. Relative odds of ANC participation by residence, maternal education, and household wealth .....	59
Appendix 7. Maternal iron supplementation—iron tablet receipt and consumption.....	60
Appendix 8. Changes in maternal iron supplementation over two consecutive DHS surveys .....	61
Appendix 9. Use of anti-malarial medicine during pregnancy .....	61
Appendix 10. Use of bednets among pregnant and non-pregnant women .....	62
Appendix 11. Use of de-worming medication during pregnancy.....	62
Appendix 12a-g. Public health significance of anemia, malaria, and hookworm by country .....	63–69

## Tables

Table 1. Women affected by anemia in the developing world.....	2
Table 2. Variables, DHS indicators, respondents, and definitions.....	11–12
Table 3. Correlation coefficients ( $\rho$ ) of country-specific estimates of ANC and iron tablet use during pregnancy .....	28
Table 4. Maternal anemia policy and program assessment guideline.....	34–35
Table 5. Maternal anemia policy and program assessment guideline, Uganda .....	36–38
Table 6. Maternal anemia policy and program assessment guideline, India.....	39–41
Table 7. Maternal anemia policy and program assessment guideline, Philippines.....	42–43

# Figures

Fig. 1	A comparison of normal and anemic red blood cells.....	1
Fig. 2	Causes of anemia .....	4
Fig. 3	Iron requirements based on dietary reference intake, Food and Nutrition Board, Institute of Medicine, 2001 .....	5
Fig. 4	Anemia prevalence among pregnant women, DHS 2003–2008.....	15
Fig. 5	Anemia prevalence among non-pregnant women, DHS 2003–2008.....	16
Fig. 6	Change in anemia prevalence among pregnant women over two consecutive DHS surveys, DHS 1998–2008 .....	17
Fig. 7	Change in anemia prevalence among non-pregnant women over two consecutive DHS surveys, DHS 1998–2008.....	18
Fig. 8	Percent of women who received antenatal care from a health provider, DHS 2003–2008 .....	19
Fig. 9	Odds ratios of at least one ANC visit by residence, maternal education and household wealth .....	20
Fig. 10	Median gestational age at first ANC visit, DHS 2003–2008.....	21
Fig. 11	Median number of ANC visits, DHS 2003–2008 .....	22
Fig. 12	Percent of women who were given or bought any iron tablets or syrup in last pregnancy, DHS 2003–2008.....	23
Fig. 13	Percent of women taking iron for 1–59, 60–89 or 90 or more days during last pregnancy, 2003–2008 .....	25
Fig. 14	Median number of days iron tablets or syrup taken during last pregnancy , DHS 2003–2008 .....	26
Fig. 15.	Change over five years in percent of women taking iron tablets or syrup for 1–59, 60–89, or 90 or more days during the last pregnancy, DHS 2000–2008 .....	27
Fig. 16	Percent of women who took an anti-malarial medicine during the last pregnancy, DHS 2003–2008.....	29
Fig. 17	Percent of pregnant women who slept under a mosquito net in the last night by type of bednet, DHS 2003–2008.....	30
Fig. 18	Percent of women taking a drug for intestinal worms in last pregnancy, DHS 2003–2008 .....	31

# Acronyms

A2Z	USAID-funded project on micronutrients and child blindness managed by AED
ACT	Artemisinin-containing antimalarial combination therapy
AIDS	Acquired immune deficiency syndrome
AMSTL	Active management of third stage of labor
ANC	Antenatal care
DHS	Demographic and Health Surveys
DOH	Department of Health
FANC	Focused antenatal care
GDP	Gross domestic product
GOI	Government of India
Hb	Hemoglobin
HIV	Human immunodeficiency virus
HMIS	Health management information systems
ICDS	Integrated Childhood Development Services
IDA	Iron deficiency anemia
IFA	Iron folic acid
IPTp	Intermittent preventive treatment for pregnant women
IQR	Inter-quartile range
IRS	Indoor residual spraying
ITN	Insecticide-treated bednet
IUD	Intra-uterine device
LAC	Latin America and the Caribbean
LLIN	Long-lasting insecticide-treated bednets
MCH	Maternal and child health
MDG	Millennium Development Goal
MOH	Ministry of Health
NGO	Non-governmental organization
PHC	Primary health center
RBCs	Red Blood Cells
S/SE	South and Southeast
SP	Sulfadoxine-pyrimethamine
TB	Tuberculosis
UNICEF	United Nations Children's Fund
WHO	World Health Organization

# Glossary of Terms

**Active management of third stage of labor (AMTSL)** is an effective measure to prevent post-partum hemorrhage. AMTSL can be delivered wherever women give birth, including at home, by trained health care providers linked to essential supplies. AMTSL speeds delivery of the placenta by increasing uterine contractions and prevents post-partum hemorrhage by averting uterine atony. The components of AMTSL are: (a) administering a uterotonic agent within one minute after the baby is born; (b) after the cord is clamped, delivering the placenta by controlled cord traction (gently pulling on the umbilical cord) with counter-traction on the fundus; and (c) giving fundal massage after the placenta is delivered.

**Anemia** is a decrease in the normal number of red blood cells or less than the normal quantity of hemoglobin (the protein in red blood cells that transports oxygen to tissues) in the blood.

**Antenatal care (ANC)** is a widely used strategy to improve the health of pregnant women, to encourage skilled care during childbirth and to provide iron and folic acid supplements and appropriate counseling messages about maternal care, birth preparation, and the use of supplements.

**Focused antenatal care (FANC)** is a new approach to ANC that emphasizes the quality, rather than the amount, of care. For normal pregnancies, four antenatal visits are recommended to help women maintain normal pregnancies by identifying pre-existing health conditions, detecting complications early that arise during the pregnancy, health promotion and disease prevention, and birth preparedness and complication readiness planning.

**Hemoglobin (Hb)** is the protein in red blood cells that transports oxygen to tissues.

**Insecticide-treated bednets (ITN)** are factory-treated nets that do not require any further treatment, or a pretreated net obtained within the past 12 months, or a net that has been soaked with insecticide within the past 12 months.

**Intermittent preventive treatment for pregnant women (IPTp)**

IPTp refers to the treatment given to pregnant women living in countries in sub-Saharan Africa with stable malaria transmission, and consists of at least two doses of sulfadoxine-pyrimethamine (SP), given at the first and second scheduled antenatal care visits (at least one month apart) after “quickening” (the first noted movement of the fetus).

**Iron and folic acid supplementation (IFA)** WHO recommends that all pregnant women in areas with high malnutrition prevalence should receive a standard dose of 60 mg iron and 400 µg folic acid daily for 6 months, together with appropriate dietary advice, to prevent anemia.

**Iron-deficiency anemia (IDA)** is anemia caused by a deficiency in iron.

**Millennium Development Goals (MDGs)** The UN Summit on the Millennium Development Goals concluded with the adoption of a global action plan to achieve eight anti-poverty goals by 2015 and the announcement of major new commitments for women's and children's health and other initiatives against poverty, hunger, and disease. The two MDGs most related to maternal anemia are (1) MDG 4, which pledges to reduce the mortality rate of children under five years of age by two-thirds, and (2) MDG 5, which pledges to reduce the maternal mortality ratio by three-quarters.

## Key Messages

### FACTS

---

- Anemia is a widely prevalent disorder affecting the lives of over half a billion women of reproductive age.
- Iron deficiency anemia (IDA), alone, contributes to over 100,000 maternal and almost 600,000 perinatal deaths each year. Inter-generational impacts include increased risk of infant mortality, pre-term delivery, low birth weight, and reduced cognitive development in children.
- Anemia results in reduced energy levels, which affect productivity, earning power, and even maternal caring practices. Economic losses due to IDA alone are estimated at approximately \$2.32 per capita or 0.6 percent of Gross Domestic Product (GDP). If cognitive losses are added, the median total losses are \$16.78 per capita or 4.05 percent of GDP.
- Anemia has multiple causes: failure to meet increased iron requirements during pregnancy, inadequate intake of micronutrients (particularly iron), closely spaced births allowing inadequate time for maternal repletion, and infections that destroy red blood cells, interfere with red blood cell formation, increase blood loss and/or deplete nutrient uptake (e.g. malaria, hookworm, HIV, diarrhea, and others).

### PURPOSE

---

- The purpose of this report is to assess the progress being made on reducing the burden of anemia in women. It also aims to stimulate global and national action to improve the reach and delivery of proven anemia reduction interventions targeting pregnant women.

## METHODS

---

- Data from DHS surveys conducted from 2004 to 2008 were used for cross-country and over-time comparisons of anemia prevalence in pregnant and non-pregnant women. These data were also used to make cross-country comparisons of the major service delivery platform for maternal anemia interventions, including antenatal care visits, and the coverage and/or reach of evidence-based anemia reduction interventions—iron tablet consumption, use of intermittent presumptive treatment for malaria, use of insecticide-treated mosquito nets, and the use of de-worming medicines.

## FINDINGS

---

- The burden of anemia in pregnant women remains serious and unacceptably high. Data from the 24 DHS surveys that collected hemoglobin levels in pregnant women confirm what has long been known—anemia in pregnancy remains a serious public health problem and is one of the most widespread disorders in pregnancy. Among the 24 countries examined, the anemia burden in pregnancy exceeded 50 percent in 13 countries, was between 30–49 percent in 10 countries, and was less than 30 percent in only one country (Haiti). Although anemia is not a specific indicator for iron-deficiency, it is assumed that a high proportion of observed anemia is due to a deficit of iron, especially during pregnancy. The consequences of iron-deficiency anemia in pregnancy are serious—higher risk of the mother's own mortality, having a low birth weight baby, neonatal mortality and possibly post-neonatal mortality, and placing the mother's infant at greater risk of iron-deficiency and declines in cognitive and motor development.
- Reducing the anemia burden in pregnant women, has progressed little especially in African countries. Among the 11 countries for which consecutive DHS surveys measured anemia in pregnant women, 8 countries (Mali, Ghana, Uganda, Senegal, Egypt, Jordan, India, Philippines) showed no measurable change or an increase in anemia prevalence over the five-year period spanning the surveys. Only three countries (Cambodia, Nepal, and Haiti) showed measureable declines in anemia prevalence. Comparing and contrasting programmatic and contextual factors between countries that have reduced their anemia burden with countries whose anemia levels have not declined may provide lessons about critical factors necessary for successful maternal anemia reduction strategies.
- The burden of anemia in non-pregnant women, while somewhat lower than that for pregnant women, puts women at risk of anemia when they become pregnant. Anemia prevalence in non-pregnant women exceeded 40 percent in 14 of the 24 countries examined. In only one country (Honduras) was the prevalence less than 20 percent. Many reproductive-age women in developing countries consume diets of low iron bioavailability and therefore are likely to start their next pregnancy with no iron stores and poor hemoglobin concentrations, putting themselves and their infant at risk of the consequences of iron-deficiency anemia.

- A high-proportion of pregnant women participate in at least one antenatal care (ANC) visit, but the correlation between ANC use and iron tablet consumption is weak. Of 34 countries, 22 reported that 80 percent or more women had at least one ANC visit during their last pregnancy. Yet, only 3 countries (Benin, Jordan, and Honduras) reported that greater than 50 percent of women had consumed 90 or more iron tablets during the last pregnancy. This large discrepancy between ANC attendance and minimally adequate maternal iron supplementation needs to be more fully examined. ANC serves as a platform for many maternal health interventions, including those such as iron supplementation, IPTp, and de-worming. Yet the low levels of iron supplementation despite high levels of ANC participation suggest issues of poor program implementation.
- In places where access to and participation in ANC care clinics is adequate, other factors need to be examined such as inadequate supply of iron tablets, which can be affected by cost and weak logistic systems; poor quality of counseling by health workers about the need for iron supplementation and its potential benefits and side-effects; lack of knowledge and concern about maternal anemia by both pregnant women and health care providers; and low motivation and some resistance among pregnant women to consume the iron supplement because of undesirable characteristics of the iron tablets or side effects experienced by women.
- Access to and participation in ANC services is not high in all countries. Fewer than two-thirds of women from Chad, Ethiopia, Niger, Nigeria, Bangladesh, and Pakistan reported having at least one ANC visit ever, or in last pregnancy. In 12 countries, the first ANC visit occurs mid-way through the 2nd trimester (5th month of pregnancy), 2–3 months later than the recommended timing of the first visit.
- Strong evidence of inequitable access to and participation in ANC exist for poorer, less educated, and/or rural women in countries such as Bangladesh, Chad, Egypt, Ethiopia, Nepal, Niger, Nigeria, and Pakistan. Special emphasis is needed to improve reach, access, and participation by these more marginalized groups.
- Improved coverage of intermittent preventive treatment for pregnant women (IPTp) in areas with high malaria endemicity is needed. Of the 15 countries for which data on antimalarial medication use during pregnancy were available, only 8 had coverage rates exceeding 50 percent. Countries such as Malawi, Senegal, and Zambia had coverage rates exceeding 80 percent, demonstrating that high coverage is possible in challenging settings. Yet, countries such as Ethiopia, Niger, Nigeria, Rwanda, Sierra Leone, Uganda, and Zimbabwe have IPTp coverage rates of less than 50 percent. It is unclear if these low rates are due to selective geographic implementation of IPTp in these countries or poor implementation. Further investigation into these issues is needed. In countries with ANC coverage rates that exceed 90 percent; such as Uganda, Zambia, and Zimbabwe, IPTp coverage could be increased rapidly if this intervention is effectively integrated into ANC services. However, in countries where ANC use is still low, such as Ethiopia, Niger, and Nigeria efforts to increase ANC access and participation along with community-outreach efforts should be explored.

- There is a need to increase use of insecticide-treated bednets (ITN) among all household members in malaria-endemic areas. Less than one-third of all pregnant and non-pregnant women slept under an ITN in all 17 countries for which data were available.
- There is a need to increase presumptive treatment of hookworms in areas where hookworms are known to be endemic. There is low de-worming coverage among pregnant women in the 13 countries for which data were available. The highest coverage rates were 38.7 percent and 34.8 percent for Zambia and Ghana, respectively, but the majority of other countries had coverage rates lower than 10 percent.

## Actions Needed

The actions recommended below are based on a review of evidence and a consultation with a broad set of stakeholders undertaken in 2008. Each country is encouraged to assess its own strategy and the degree to which each component of the strategy is being adequately supported and implemented before selecting from actions below or other actions.

### **Increase political commitment**

- Call for a renewed commitment to anemia control building on the strong links between maternal anemia reduction and maternal and perinatal survival which are central to MDGs 4 and 5, and extend the concern beyond the MGDs to include women's well-being.
- Improve coordination between global stakeholders, including the private sector, to prioritize key activities.
- Provide adequate funding for scale-up and service delivery throughout the maternal health continuum of care.

### **Integrate with health programs**

- Increase focus and attention on the multiple causes of maternal anemia to result in more effective programs through more harmonized and integrated implementation of prevention and treatment efforts.
- Identify and nurture champions for maternal anemia within maternal and child health and nutrition, reproductive health, malaria, human immunodeficiency virus (HIV), tuberculosis (TB), and neglected tropical diseases communities.
- Integrate standard anemia control strategies, training, messages, and protocols across focus ANC /birth/postpartum and infectious disease policies, guidelines, and programs.

**Provide pharmaceuticals and supplies**

- Strengthen and maintain strong supply systems for maternal anemia control activities.
- Ensure adequate, quality supplies of iron and folic acid (IFA) for supplementation, oxytocin for active management of third stage of labor (AMTSL) or misoprostol for community-based use, and contraceptives for birth spacing.
- Ensure availability of antihelminths where hookworm is present, and ensure availability of locally effective antimalarial medications, bednets, and insecticides for spraying in malaria endemic areas.
- Increase the safety of packaging, ease of use, and affordability of commodities through public-private-community linkages.

**Expand roles for communities**

- Engage and capacitate communities to increase women's access to the full package of services to prevent common causes of anemia.
- Use complementary service delivery platforms, such as community-based distribution, to reach pregnant women.
- Build community-clinic linkages to bridge the gap between community advocacy/support and clinical service delivery.
- Use community health networks to bring needed services, supplies, and follow-up directly to the homes of pregnant women.
- Listen and take action to overcome the barriers women face in accessing anemia prevention and treatment to develop context-relevant approaches, such as providing the full course of IFA at first treatment.

**Increase demand**

- Use social mobilization to create awareness of and demand for services and supplies. Counseling at community and health service levels can help women understand and adhere to IFA supplementation, family planning, and other interventions.
- Use supportive supervision systems to reinforce adequate counseling of pregnant women and ensure that local realities are addressed in the counseling provided.
- Empower health workers and volunteers to be able to provide quality counseling to improve adherence.

**Strengthen monitoring and evaluation**

- Facilitate quality service delivery of interventions addressing the root causes of maternal anemia by monitoring program implementation indicators.
- Integrate indicators on quality and coverage of ANC, family planning and reproductive health, malaria prevention, and other health services into routine health information systems.
- Establish supportive supervision systems for both clinical staff and community-based volunteers to use the information to address gaps in implementation and reinforce program progress.





## 1.0

# Overview

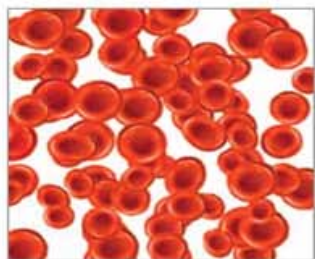
## 1.1 WHAT IS ANEMIA?

---

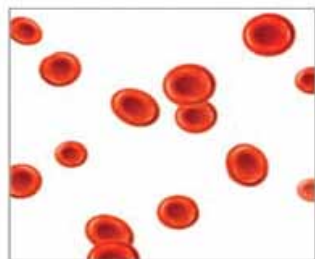
The word “Anemia” comes from the Ancient Greek meaning “lack of blood.” It is a decrease in the normal number of red blood cells (RBCs), or less than the normal quantity of hemoglobin (the protein in RBCs that transports oxygen to tissues) in the blood (**Figure 1**).

Figure 1. A comparison of normal and anemic red blood cells

Normal amount of  
red blood cells



Anemic amount of  
red blood cells



Artists rendition of normal and anemic amount of red blood cells.

## 1.2 THE CHALLENGE OF MATERNAL ANEMIA

---

Anemia affects more than 500 million women in developing countries, leaving in its wake an unacceptable burden of preventable morbidity and mortality, decreased economic productivity and lost opportunities for human, social, and economic development.<sup>1</sup> Based on WHO's most recent estimates, 4 of every 10 pregnant women and 3 of every 10 non-pregnant women are anemic.<sup>1</sup> Data suggest that when anemia prevalence is 20 percent, iron deficiency exists in 50 percent of the population. When anemia prevalence is greater than 40 percent, the entire population suffers from some degree of iron deficiency. Africa is home to the highest prevalence of anemia in all risk groups with approximately 55 percent of all pregnant women being anemic, followed by Asia where approximately 42 percent of pregnant women are anemic. In absolute numbers, anemia affects 56 million pregnant and 468 million non-pregnant women. Most are in Asia, with 31.7 million anemic pregnant and 318.3 million anemic non-pregnant women, followed by Africa, with, 19.3 million anemic pregnant and 82.9 million anemic non-pregnant women (**Table 1**).<sup>1</sup>

Table 1. Women affected by anemia

UN Region	Pregnant women		Non-pregnant women	
	Prevalence & 95% CI (%)	No. affected in millions & 95% CI	Prevalence & 95% CI (%)	No. affected in millions & 95% CI
Africa	55.8 (51.9, 59.6)	19.3 (18.0, 20.7)	44.4 (40.9, 47.8)	82.9 (76.5, 89.4)
Asia	41.6 (39.0, 44.2)	31.7 (29.7, 33.6)	33.0 (31.3, 34.7)	318.3 (302.0, 334.6)
Europe	18.7 (12.3, 25.1)	1.4 (0.9, 1.8)	15.2 (10.5, 19.9)	26.6 (18.4, 34.9)
LAC	31.1 (21.8, 40.4)	3.6 (2.5, 4.7)	23.5 (15.9, 31.0)	33.0 (22.4, 43.6)
NA	6.1 (3.4, 8.8)	0.3 (0.2, 0.4)	7.6 (5.9, 9.4)	6.0 (4.6, 7.3)
Oceania	30.4 (17.0, 43.9)	0.2 (0.1, 0.2)	1.5 (0.7, 2.4)	1.5 (0.7, 2.4)
Total	41.8 (39.9, 43.8)	56 (54, 59)	30.2 (28.7, 31.6)	468 (446, 491)

\*UN regions: Africa, Asia, Europe, Latin America and the Caribbean (LAC), Northern America (NA) and Oceania.

Source: McLean E, Cogswell M, Egli E, Wojdyla D, de Benoist B. Worldwide prevalence of anemia. WHO Vitamin and Mineral Nutrition Information System, 1993–2005, 2008, Public Health Nutrition: 12(4), 444–454.

### 1.3 CONSEQUENCES: WHAT IS AT STAKE?

**Increased risk of maternal death.** For women, iron deficiency is one of the most common forms of malnutrition and, based on observational data, is estimated to be a risk factor for ~20 percent of maternal deaths worldwide.<sup>2</sup> This high estimate is based on the strong and continuous relationship between hemoglobin concentration in pregnancy and risk of maternal death, along with assumptions about the proportion of maternal anemia caused by iron deficiency. New analyses show that for every 1.0 g/dL increase in hemoglobin among anemic pregnant women, the risk of maternal death decreases by approximately 20 percent, making anemia control and prevention in pregnancy an important strategy to reduce maternal deaths.<sup>2,3</sup> Therefore, public health interventions should focus on preventing and reducing all degrees of iron deficiency anemia in pregnancy.

**Anemia and HIV.** Anemia is also a particular concern within the context of the HIV/AIDS context as it can exacerbate the progression and effects of the infection and possibly increase maternal-to-child transmission of HIV.<sup>4</sup> For example, severe anemia is associated with increased adverse outcomes in HIV positive cases such as fetal loss or stillbirth, preterm birth, low birth weight and MTCT of HIV by the time of birth, and by 4–6 weeks among those negative at birth.<sup>5</sup> Preventing severe anemia reduces the need for blood transfusions, which carries a risk of HIV transmission.<sup>6</sup> Severe anemia in post-partum women has been associated with about a three-fold increased risk of HIV incidence.<sup>7</sup>

**Anemia and pregnancy and child outcomes.** A growing body of evidence links iron supplementation in pregnancy with improved pregnancy and child outcomes. Anemia in pregnancy has been linked to an increased risk of low birth weight,<sup>8,9</sup> pre-term birth,<sup>9</sup> infant<sup>9-11</sup> and child mortality,<sup>12</sup> and an increased risk of iron deficiency in

infants after 4 months of age,<sup>13</sup> predisposing the young child to cognitive impairment and psychomotor and mental development.<sup>14</sup>

Two large recent clinical trials strongly suggest the benefits of maternal iron supplementation for the fetus, neonate, and young children. A recent study in rural Chinese women, comparing iron and folic acid with folic acid alone, on birth and neonatal outcomes found a significant 50 percent reduction in very preterm births and 54 percent reduction in neonatal mortality among women given iron and folic acid during pregnancy.<sup>9</sup> A recent trial from Nepal found that women who received daily iron and folic acid beginning early in pregnancy experienced a significant but modest 16 percent reduction in low birth weight of their babies (<2500g).<sup>12</sup>

Also, the mortality impact of improving iron status during pregnancy appears to last longer than previously recognized. Based on 7 years of post-natal follow-up among surviving off-spring of women enrolled in the above Nepal study, children of mothers who received iron and folic acid during pregnancy had childhood mortality rates that were 31 percent lower than children of mothers who had received placebo.<sup>12</sup> These children also scored significantly higher on a battery of cognitive tests compared with children whose mothers received placebo.<sup>15</sup>

**Anemia and economic productivity.** Anemia has significant implications for the agricultural and industrial sectors because of its effect on reduced functional capacity in adults, especially related to reduced ability to do physical work. This relationship appears to exist for all levels of iron deficiency and voluntary physical activity.<sup>16</sup> In addition, the energy costs to do physical tasks are higher for anemic versus non-anemic adults, which leaves anemic individuals less energy to take on other important child care, household, and other responsibilities.<sup>16</sup> In low-income, food-deficit countries where almost 70 percent of women work in agriculture, the high prevalence of anemia is a challenge for the agricultural sector, where reduced work capacity may lead to less food grown, less income earned, and higher levels of poverty and food insecurity.

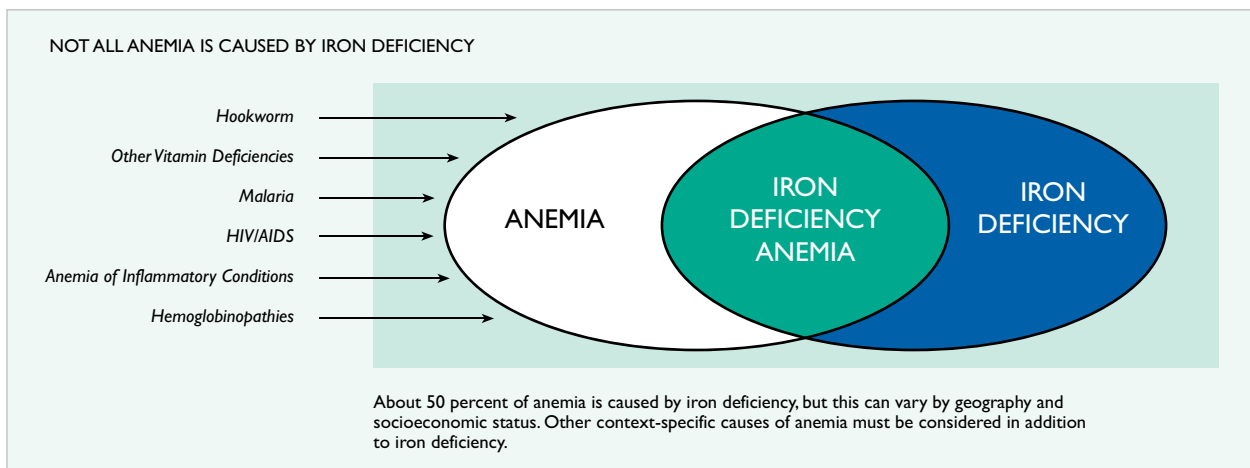
In addition to economic productivity losses, iron deficiency has been shown to delay and impair motor and cognitive development in children.<sup>14,17,18,19,20</sup> Based on the calculations made by economists for 10 developing countries, economic losses due to iron deficiency related to physical productivity are around \$2.32 per capita or 0.57 percent of GDP.<sup>21</sup> If cognitive losses are added, the median total losses are \$16.78 per capita or 4.05 percent of GDP.<sup>21</sup>

#### **1.4 WHAT CAUSES ANEMIA IN WOMEN?**

A large proportion of anemia is caused by iron deficiency, but anemia is not a specific indicator for iron deficiency because it can be caused by factors other than lack of iron (**Figure 2**). Anemia has multiple precipitating factors that can occur in isolation but more frequently co-occur. In addition to poor bioavailability of dietary iron, intestinal worm infections (and particularly blood loss from hookworm

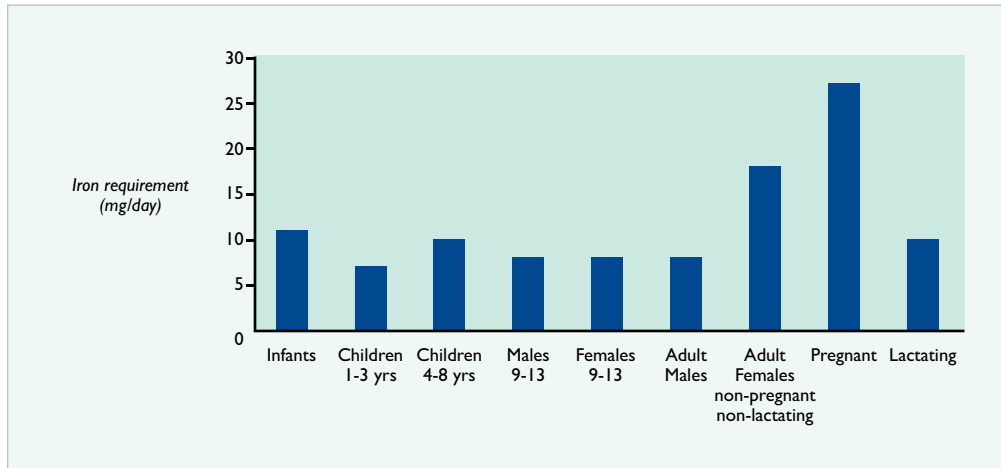
infections) and malaria compound the problem of anemia in many areas.<sup>22</sup> Other important factors include vitamin deficiencies such as folate and vitamin A deficiency; a variety of infections, including malaria and HIV infection; and hemoglobinopathies. In places where there are multiple causes of anemia, interventions addressing one cause but not the others are unlikely to be adequate to decrease the anemia burden. In these contexts, multi-pronged approaches to the problem are needed, and that often means integrating across health sectors and delivery platforms. **Appendix 12** provides country-specific information on the extent to which anemia, malaria, and hookworm are co-occurring public health problems.

Figure 2. Causes of anemia



It is thought that about half the anemia in pregnant women is due to iron deficiency, but this proportion can vary across geography, socioeconomic status, and other factors.<sup>23</sup> Iron deficiency is caused by high iron requirements during critical periods in the life cycle that are not met by iron absorption in diet, especially in populations consuming foods with low dietary bioavailability of iron from plant-based diets with little meat. Many women are iron deficient anemic even before they become pregnant. In teenage girls menstrual blood losses superimposed with increased iron requirements from adolescent growth, put them at a higher risk for iron deficiency. In pregnancy, iron requirements increase three-fold from expanding maternal red-cell mass and the growing placenta and fetus. This means iron requirements during pregnancy increase by one gram, which is equivalent to four units of blood **(Figure 3)**. This high requirement for iron places pregnant women at a high risk for iron deficiency.

Figure 3. Iron requirements based on dietary reference intake, Food and Nutrition Board, Institute of Medicine, 2001



## I.5 EFFECTIVE INTERVENTIONS TO REDUCE MATERNAL ANEMIA

Broad scientific consensus exists on how to prevent and treat the major causes of anemia in pregnancy, however the challenge remains in identifying “how” to translate and integrate what is known into large-scale, effective intervention programs.

When applied effectively to populations with known causes of anemia, these interventions have been shown to reduce the burden of iron deficiency and other major causes of anemia:

### I. Iron supplementation

- a. Daily Supplementation during Pregnancy.** No doubt exists that iron supplementation during pregnancy prevents maternal iron deficiency and anemia, and increases hemoglobin concentrations.<sup>24</sup> Currently WHO recommends universal daily iron (60 mg) and folic acid (400 µg) supplementation for pregnant women for six months where anemia is widespread.<sup>25</sup>



PHOTO CREDIT: AED

- b. Weekly Supplementation for Women of Reproductive Age.** This intervention involves providing a weekly dose of iron and folic acid to non-pregnant women of reproductive age and aims to improve the iron status of women prior to conception, as well as to provide folic acid in the peri-conceptional period when it is most efficacious to prevent neural tube defects



PHOTO CREDIT: AED

in the developing fetus. A recent WHO position statement advocates for weekly supplementation.<sup>25,26</sup> This approach needs more programmatic experience because it requires creating both an effective supply chain (through the private sector or public-private partnerships) and a demand for supplements amongst women.

- 2. Presumptive treatment of hookworms in areas where hookworms are known to be endemic.** Data from the 1990's suggest that 44 million of 124 million pregnant women in the developing world (more than 1/3) harbor hookworm infection.<sup>27</sup> Hookworm can lead to gastrointestinal blood loss, poor nutrient absorption, and inhibition/suppression of appetite—which can aggravate iron deficiency and anemia in pregnancy. Where hookworm prevalence is greater than 20 percent, providing de-worming medications such as albendazole and mebendazole is recommended beginning in the second trimester of pregnancy as a routine part of ANC.

**3. Malaria control**

**a. Intermittent preventive treatment for pregnant women (IPTp).**

All pregnant women at risk of *P. falciparum* infection in countries in sub-Saharan Africa with stable malaria transmission, should receive at least two doses of sulfadoxine-pyrimethamine (SP), given at the first and second scheduled antenatal care visits (at least one month apart) after “quicken-ing” (the first noted movement of the fetus). The doses of SP should be taken under direct observation during the antenatal visits.



PHOTO CREDIT: CHRISTIAN MEYN

- b. Insecticide treated bednets (ITN).** A mosquito net offers protection against mosquitoes and other insects, and thus against diseases such as malaria, dengue fever, yellow fever, and various forms of encephalitis. ITNs are estimated to be about 40 percent more effective than untreated nets.<sup>28</sup> ITNs protect people sleeping under the net and simultaneously kill mosquitoes that contact the net.



PHOTO CREDIT: DARCY KIEFEL

**c. Indoor residual spraying (IRS).** IRS is the process of spraying the inside of dwellings with an insecticide to kill mosquitoes that spread malaria. A diluted solution of insecticide is sprayed on the inside walls of certain types of dwellings—those with walls made from porous materials such as mud or wood but not plaster as in city dwellings. Mosquitoes are killed or repelled by the spray, preventing disease transmission.

**d. Artemisinin-containing antimalarial combination therapy (ACT).** Artemisinin and its derivatives are a group of drugs that possess the most rapid action of all current drugs against falciparum malaria.<sup>29</sup> Treatments containing an artemisinin derivative are now standard treatment worldwide for falciparum malaria.



PHOTO CREDIT: COLBY GOTTE



## 2.0

# Purpose and Methods

## 2.1 PURPOSE

---

The purpose of this report is to assess the progress being made on reducing the burden of anemia in women. It also aims to stimulate global and national action to improve the reach and delivery of proven anemia reduction interventions targeting pregnant women. This report documents the most current cross-country estimates of anemia in pregnant and non-pregnant women, the use of ANC (as a major service delivery platform for key maternal health services), and the reach of anemia reduction interventions during pregnancy—including iron tablet consumption, use of insecticide-treated bednets and de-worming medicine—from 2004–2008 DHS survey data. This report also examines whether and how these indicators have changed over time in countries where data exist for two time periods. The findings are grouped by region to facilitate easy within-region comparisons. Findings are also interpreted and highlight questions and issues for national policy makers and program managers that may require further investigation or contextual knowledge. This report is intended to facilitate intensified efforts by global and national policy makers to improve efforts to reduce what is arguably one of the most prevalent and serious conditions affecting pregnant and non-pregnant woman in the developing world – anemia.

## 2.2 METHODS

---

### Data Used

Data from DHS surveys conducted from 2004 to 2008 were used for their national representativeness, methodological comparability across countries and over time, access and currency. All countries with survey data available via StatCompiler (<http://www.statcompiler.com/>) between 2004 and 2008 were identified to provide the most recent estimates of prevalence, ANC coverage, and intervention reach. For evaluating changes in these estimates over time, data from preceding DHS surveys, when available, were identified and used.

Nationally representative data for 24 countries were identified for anemia prevalence in pregnant and non-pregnant women—23 countries had DHS surveys conducted between 2004 and 2008 and one country (Philippines) had data from a 2008 National Nutrition Survey. Changes in anemia prevalence over time were based on data from eleven countries; nine that had anemia data for two consecutive DHS surveys and two (Nepal and Philippines) that had prevalence data from previous nationally representative surveys. The number of countries included in the cross-country comparisons depended on the data available from DHS surveys through 2008. This number was 34 for ANC use comparisons, 33 for maternal iron and folic acid supplementation coverage, 16 for use of anti-malarials in pregnancy, 18 for bednet use, and 13 for use of de-worming medicines during pregnancy.

## Definition of Variables

**Anemia.** Anemia in pregnant and non-pregnant women was defined as having a hemoglobin below 11 g/dL and below 12 g/dL, respectively, and adjusted for smoking status and altitude within most DHS datasets. Mild, moderate, and severe anemia in pregnancy were defined as hemoglobin between 10.0 and 10.9 g/dL, 7 and 9.9 g/dL, and less than 7 g/dL respectively. The same definitions were used for non-pregnant women except for mild anemia, which was defined as hemoglobin between 10.0 and 11.9 g/d. Data from the 1998 Nepal National Micronutrient Status Survey, which grouped mild with moderate anemia could not be disaggregated, and is therefore presented in aggregated form. Anemia prevalence data for non-pregnant women is available from StatCompiler for non-pregnant breastfeeding and non-pregnant, non-breastfeeding women. Weighted estimates were computed and prevalence data are presented for the combined group (i.e. all non-pregnant women).

**Antenatal care, timing, and number of visits.** The following three DHS questions were used to estimate antenatal care coverage, the gestational age at first ANC visit, and the number of ANC visits respectively: (1) “Did you see anyone for antenatal care for this pregnancy?” (2) “How many months pregnant were you when you first received antenatal care for this pregnancy?” and (3) “How many times did you receive antenatal care during this pregnancy?” Antenatal care is defined by DHS as care received from a doctor or a trained medical professional (midwife, nurse). DHS collects this information for the most recent pregnancy among all women between 15 and 49 years of age who had a live birth in the 3 years preceding the survey. To compute median number and inter-quartile range (IQR) of ANC visits, and median IQR gestational age of the first ANC visit, survey datasets were downloaded and the median and IQR for these variables were calculated for respondents that had attended at least one ANC visit. Missing and “Don’t know” responses were not included in the denominator.

**Iron tablet receipt and consumption.** The following two DHS questions were used to estimate iron tablet receipt and consumption, respectively: (1) “During this pregnancy, were you given or did you buy any iron tablets or iron syrup?” and (2) “During the whole pregnancy, for how many days did you take the tablets or syrup?” The median IQR number of days that a woman consumed an iron tablet or syrup was computed for women reporting taking iron for at least one day during her last pregnancy.

**De-worming medicine.** The DHS question, “During this pregnancy, did you take any drug for intestinal worms?” asked of women 15–49 years of age who had a live born child in the five years preceding the survey, was used to estimate the reach of de-worming during pregnancy. This information was only available from a limited number of DHS surveys.

**Use of malaria prophylaxis.** To estimate use of malaria prophylaxis during pregnancy, the DHS question “During this pregnancy did you take any drugs to keep you from getting malaria?” was used. This information is obtained from women who had a live birth within two years preceding the DHS survey.

**Use of insecticide-treated bednets (ITN).** The DHS uses standardized household questionnaires with a net roster linked to a list of all household occupants who slept under each net the previous night to ascertain household ITN possession and use. The series of questions included in the malaria module to ascertain ITN possession and use include, “Does your household have any mosquito nets that can be used while sleeping;” “How long ago did your household obtain the mosquito net?;” “Since you got the mosquito net, was it ever soaked or dipped in a liquid to repel mosquitoes or bugs?;” “Did anyone sleep under this mosquito net last night?;” “Who slept under this mosquito net last night?.”

### Data Analysis

To compute medians and IQR for country-level data, country-specific DHS data files were analyzed using IBM SPSS Statistics 17. Country-level prevalence, coverage, and intervention use estimates obtained from STATCompiler were entered into spreadsheets and converted into Stata format to facilitate graphic analysis and presentation by Stata® 11 (StataCorp, College Station, Texas). To examine the extent to which maternal anemia services had equitable coverage, we computed odds ratios to compare coverage rates between women from the lowest and highest wealth quintile households, women with no and secondary schooling and women residing in rural and urban areas. Odds ratios that are close to one suggest that services are equitably provided and odds ratios that are far lower or higher than one suggest inequitable coverage by the variable being examined (i.e. income, education or geographic residence).

Table 2. Variables, DHS indicators, respondents, and definitions

Variable	DHS Indicator/ Question Used	Respondents	Definition
Anemia in pregnancy	Hemoglobin (Hb)	Pregnant women in 3rd trimester	Any: Hb < 11 g/dL Severe: Hb < 7 g/dL Moderate: 7 g/dL ≤ Hb ≤ 10 g/dL Mild: 10 g/dL ≤ Hb ≤ 11 g/dL
Anemia in non-pregnant women	Hemoglobin (Hb)	Non-pregnant women 15–49 years of age	Any: Hb < 12 g/dL Severe: Hb < 7 g/dL Moderate: 7 g/dL ≤ Hb ≤ 10 g/dL Mild: 10 g/dL ≤ Hb ≤ 12 g/dL
Received any ANC during last pregnancy?	Did you see anyone for ANC for this pregnancy?	Reproductive age women (15–49 years of age) who had given birth within the 3 years preceding the survey	Only ANC received from a doctor or trained medical professional considered.
Timing of first ANC visit during last pregnancy	How many months pregnant were you when you first received ANC for this pregnancy?	Reproductive age women (15–49 years of age) who had given birth within the 3 years preceding the survey	Only ANC received from a doctor or trained medical professional considered.

Table 2. Variables, DHS indicators, respondents, and definitions (continued)

Variable	DHS Indicator/ Question Used	Respondents	Definition
Number of ANC visits during last pregnancy	How many times did you receive ANC during this pregnancy?	Reproductive age women (15–49 years of age) who had given birth within the 3 years preceding the survey.	Only ANC received from a doctor or trained medical professional considered.
Iron tablet receipt during last pregnancy	During this pregnancy, were you given or did you buy any iron tablets or syrup?	Reproductive age women (15–49 years of age) who had given birth within the 3 years preceding the survey	
Iron tablet consumption during last pregnancy	During the whole pregnancy, for how many days did you take the tablets or syrup?	Reproductive age women (15–49 years of age) who had given birth within the 3 years preceding the survey	
Consumption of de-worming medicine during last pregnancy	During this pregnancy, did you take any drug for intestinal worms?	Reproductive age women (15–49 years of age) who had given birth within the 5 years preceding the survey	
Use of anti-malarials during last pregnancy	During this pregnancy, did you take any drugs to keep you from getting malaria?	Reproductive age women (15–49 years of age) who had given birth within the 2 years preceding the survey	
Women and pregnant women who slept under a mosquito net (treated or untreated), who slept under an ever-treated net, and who slept under an insecticide-treated net the night before the survey.	Does your household have any mosquito nets that can be used while sleeping? How long ago did your household obtain the mosquito net? Since you got the mosquito net, was it ever soaked or dipped in a liquid to repel mosquitoes or bugs? Did anyone sleep under this mosquito net last night? Who slept under this mosquito net last night?	Reproductive age women (15–49 years of age) and pregnant women in the household during the day of the survey.	An ever-treated net is a pre-treated net or a non-pretreated that has been soaked with insecticide at any time. An insecticide-treated net is 1) a factory-treated net that does not require any further treatment, or 2) a pretreated net obtained within the past 12 months, or 3) a net that has been soaked with insecticide within the past 12 months.



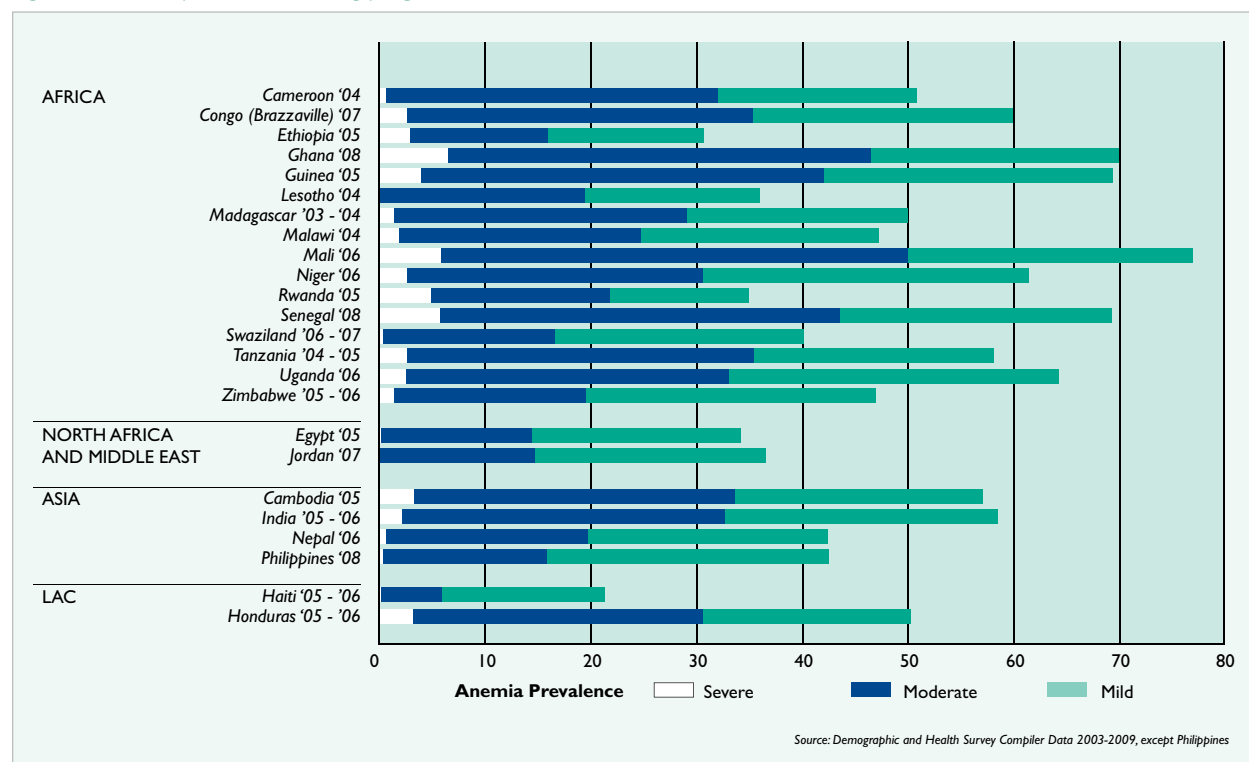


## 3.0 Findings

### 3.1 ANEMIA IN WOMEN: WHERE WE STAND

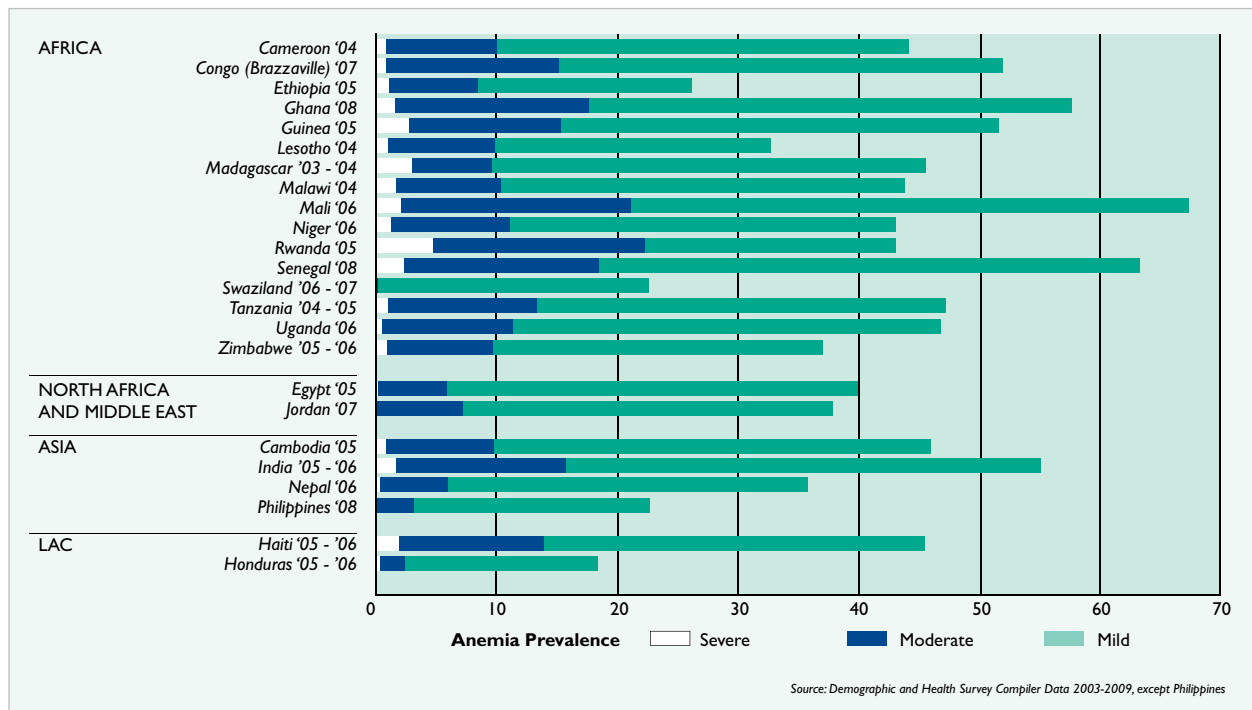
**Pregnant women.** WHO considers anemia to be a mild, moderate, or severe public health problem if the anemia prevalence in pregnant women is 5–19 percent, 20–39 percent and greater or equal to 40 percent, respectively<sup>24</sup>. All 24 countries that measured hemoglobin in pregnancy as part of the DHS survey had maternal anemia prevalence rates exceeding WHO’s “moderate public health problem” threshold, and 18 countries exceeded the “severe public health problem” threshold. The highest prevalence rates are in Mali (77%), followed by Ghana (70%), Senegal (69.4%), Guinea (69%), Uganda (64%), Niger (62%), and Congo-Brazzaville (60%) (**Figure 4** and **Appendix I**). Overall maternal anemia rates can be further examined by the proportion of women who are severely (i.e. hemoglobin < 7 g/dl), moderately (hemoglobin 7–9.9 g/dl) and mildly (10–10.9 g/dl) anemic. The prevalence of severe anemia was ≥ 5 percent in four African countries (Ghana, Mali, Rwanda, and Senegal) and moderate anemia greater than or equal to 30 percent in 10 countries. These data point to the need for urgent, concerted, and comprehensive actions to reduce anemia levels in pregnant women.

Figure 4. Anemia prevalence among pregnant women, DHS 2003–2008



**Non-pregnant women.** Women who begin pregnancy already anemic have an even higher risk of negative health consequences for themselves and their fetus. Anemia rates among non-pregnant women provide an indication of the proportion of women who are likely to start their pregnancy suffering from anemia. All countries surveyed, with the exception of Honduras, had prevalence rates that exceeded the threshold indicating a “moderate public health problem” (greater than or equal to 20%). In 14 of 24 countries, 40 percent or more of non-pregnant women were anemic, and in Democratic Republic of Congo (DRC), Congo-Brazzaville, Ghana, Guinea, Mali, Senegal, and India, more than half of non-pregnant women were anemic (**Figure 5** and **Appendix 2**). The country with the lowest anemia prevalence in non-pregnant women was Honduras (18.5%), however, this rate still exceeds the threshold indicating a mild public health problem.

Figure 5. Anemia prevalence among non-pregnant women, DHS 2003–2008



### 3.2 CHANGES OVER FIVE YEARS IN ANEMIA PREVALENCE IN WOMEN

Prevalence data from two national surveys conducted over an approximate 5 year interval were available for 11 countries to examine trends in anemia prevalence in pregnant and non-pregnant women over time.

**Pregnant women.** In five of the eleven countries, anemia prevalence in pregnant women increased during the five-year interval—Uganda (23.2% increase), Egypt (10.6% increase), India (8.9% increase), Ghana (8.9% increase), and Mali (3.5% increase). In three countries—Jordan, Senegal, and Philippines—anemia levels did not substantially change, and in three countries there were substantial reductions—Nepal (32.1% decrease), Haiti (13.1% decrease) and Cambodia (8.0% decrease) (**Figure 6** and **Appendix 3**). Severe anemia increased in Ghana by 5.4 percent, moderate anemia increased by >13 percent in both Ghana and Uganda.

**Non-pregnant women.** Among non-pregnant women, there was an absolute increase in anemia prevalence in 7 of the 11 countries—Uganda (16.8% increase), Ghana (15.0% increase), Egypt (11.9% increase), Jordan (9.9%), Mali (6.8% increase), Senegal (6.1%) and India (3.2% increase). Increases in mild (10 g/L ≤ Hb < 12 g/L) anemia accounted for the largest proportion of the overall increase in all seven countries (**Figure 7** and **Appendix 4**). In four countries, anemia prevalence in non-pregnant women substantially decreased with the greatest absolute reductions observed in Nepal (30.9%), Cambodia (12.4%), Philippines (10.9%), Haiti (9.0%) and Senegal (5%).

Figure 6. Change in anemia prevalence among pregnant women over two consecutive DHS surveys, DHS 1998–2008

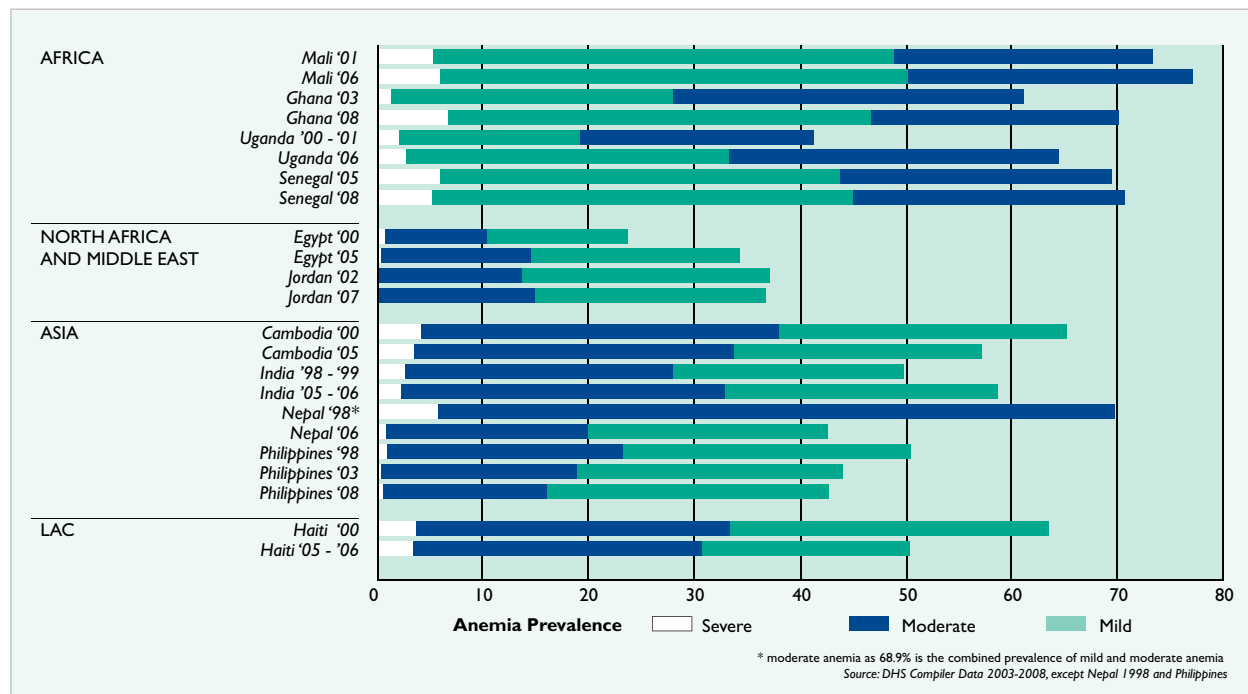
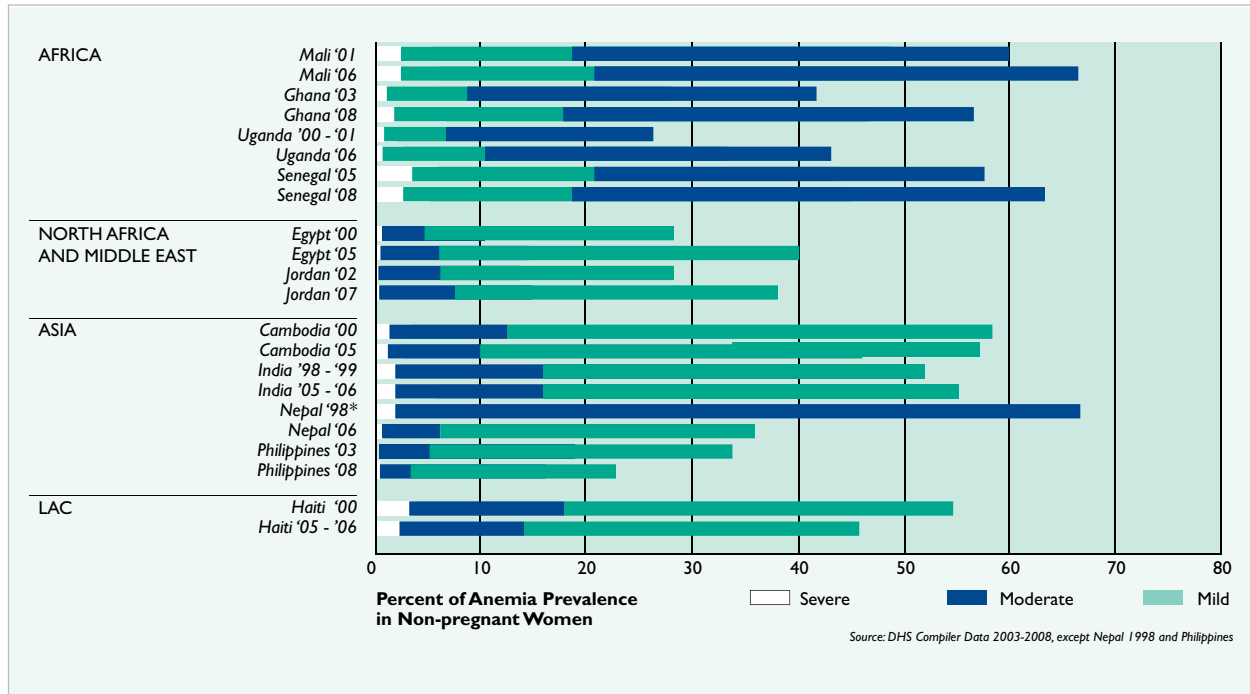


Figure 7. Change in anemia prevalence among non-pregnant women over two consecutive DHS surveys, DHS 1998–2008

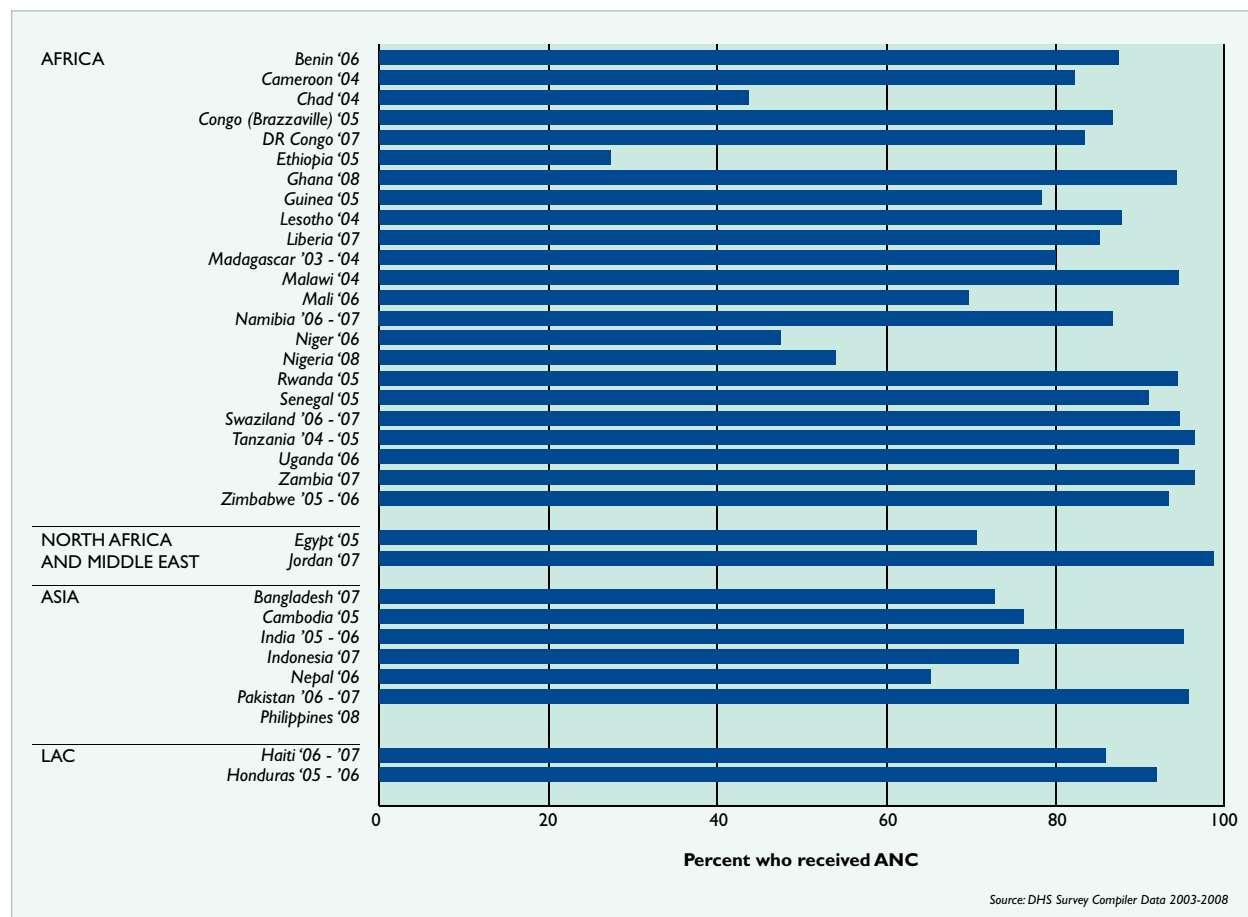


### 3.3 ANTENATAL CARE AS A SERVICE DELIVERY PLATFORM FOR REACHING PREGNANT WOMEN

Antenatal care (ANC) is a widely used strategy to improve the health of pregnant women, to encourage skilled care during childbirth, and to provide iron and folic acid supplements and appropriate counseling messages about maternal care, birth preparation, and the use of supplements. WHO, through a new focused antenatal care approach, has tried to focus antenatal care to a limited number of visits and proven interventions. The number of recommended ANC visits was reduced to four, and visits focus on health promotion and disease prevention which includes explicitly reducing iron deficiency anemia, giving presumptive treatment for hookworm where prevalent, and several other services.

**Proportion of women who had at least one ANC visit with a health provider.** The proportion of women who attended at least one ANC visit with a health provider during her last pregnancy ranged from a low of 27 percent in Ethiopia to a high of 99 percent in Jordan (**Figure 8** and **Appendix 5**). Among the 23 African countries, nine had coverage rates of 90 percent or better for at least one ANC visit and another eight had coverage rates between 80–89 percent. The remaining six countries (Ethiopia, Chad, Guinea, Mali, Niger and Nigeria) in Africa had coverage rates ranging from 27.4 to 78.5 percent. In Asia, the proportion of women who had one or more ANC visits ranged from a low of 62.6 percent in Bangladesh to a high of 95.8 percent in the Philippines. In Latin America and the Caribbean, both Haiti and Honduras had ANC coverage rates exceeding 85 percent.

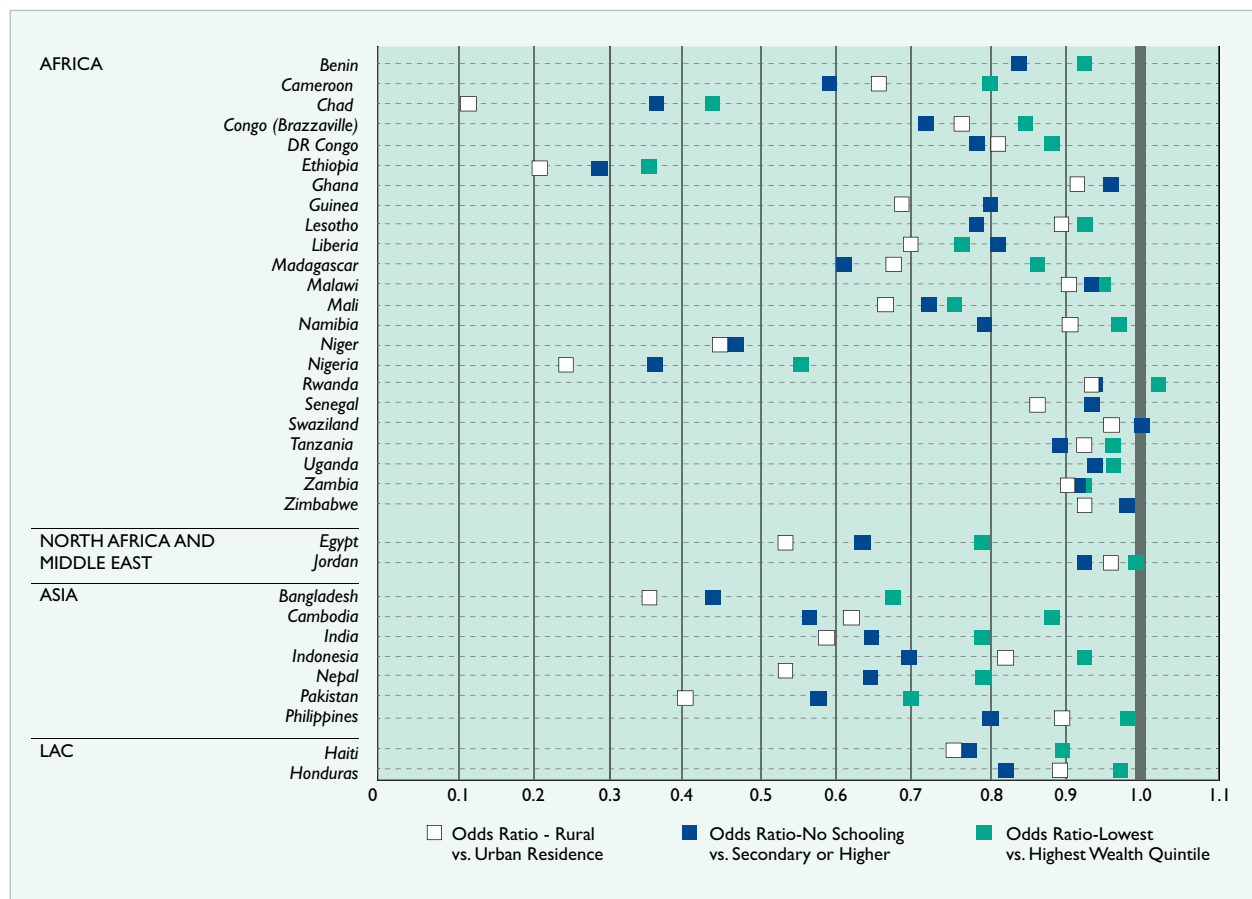
Figure 8. Percent of women who received antenatal care from a health provider; DHS 2003–2008



**ANC visit by household wealth, maternal education, and location of residence.** We explored the existence of disparities with respect to use of ANC services by examining the relative proportions of women who had an ANC visit by household wealth quintile, educational attainment and geographic residence. **Figure 9** displays the odds ratios of ANC use by poorest versus richest households, women with no formal education versus those who completed secondary education, and women who live in rural versus urban areas. An odds ratio of less than 1.0 indicates that women from the first category were less likely to receive at least one ANC visit compared to women in the second category. The smaller the odds ratio, the greater the disparity between the two groups. For example, in women from the poorest households in Tanzania were about 6 percent less likely (odds ratio=0.94) to have had an ANC visit compared with women from the richest households, indicating reasonable and equitable access of ANC services across wealth categories. However, women from the poorest households in Niger were 55 percent less likely (odds ratio=0.45) to have had an ANC visit compared with women from the richest households suggesting very inequitable access of ANC services across wealth categories. **Appendix 6** provides the raw data from which the odds ratios were computed.

Evidence of equity disparities related to ANC use by household wealth and maternal education were apparent in all countries because the odds ratios were all below 1.0, although the magnitude of these disparities varied considerably. Overall Chad, Ethiopia, and Nigeria had the greatest discrepancies in ANC use by household wealth. Women from the poorest households in Chad were eight times less likely to attend an ANC visit compared to women from the richest households. In Nigeria and Chad, women who live in rural areas or had no schooling were two to three times less likely to have attended an ANC visit compared to women who live in an urban area or completed secondary school. Variability across the three factors was considerably less in southern African countries, although women with no schooling and from the poorest households in Madagascar were 40 percent and 30 percent less likely to have had an ANC visit during their last pregnancy, respectively. In Jordan, only very small differences across the three factors existed, but women from the poorest households and with no education were 35 to 45 percent less likely to have had an ANC visit in Egypt compared to women from the wealthiest households who completed secondary education. In Asian countries, differences in equity discrepancies were more pronounced by wealth and maternal education, with the widest disparities in Bangladesh and Pakistan.

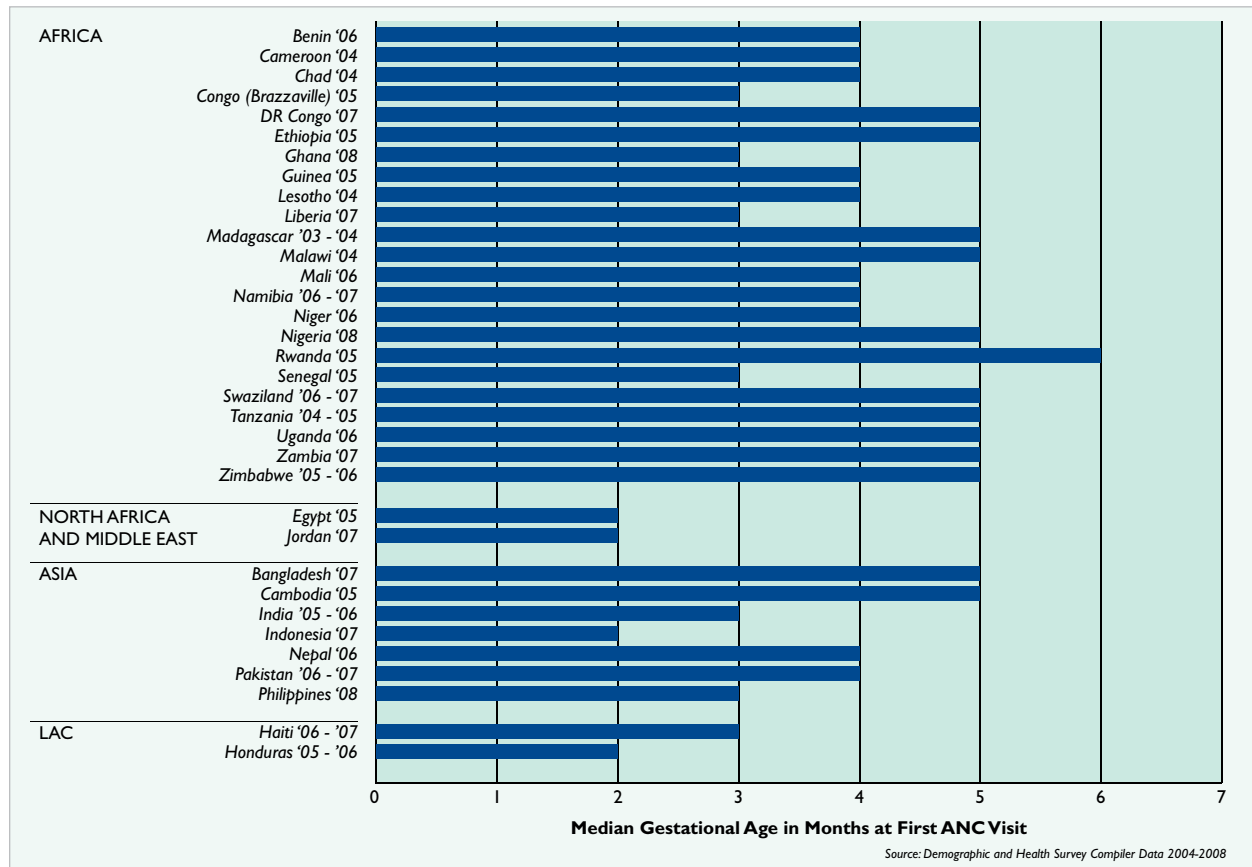
Figure 9. Odds ratios of at least one ANC visit by residence, maternal education, and household wealth



**Gestational age at first ANC visit.** WHO guidelines recommend that the first ANC visit occur as early as possible in pregnancy, and preferably in the first trimester to provide preventive measures (e.g. tetanus toxoid immunization), screen for underlying conditions and diseases (e.g. malaria, STDs, HIV), and provide health education and promotion for the woman and her family.<sup>30</sup> Strong evidence also shows that iron deficiency in the first trimester of pregnancy results in significant decrements in fetal growth, although most iron intervention programs rely on initiating treatment at the first visit of the newly pregnant woman to her health care provider, which often occurs in the second trimester.<sup>31</sup>

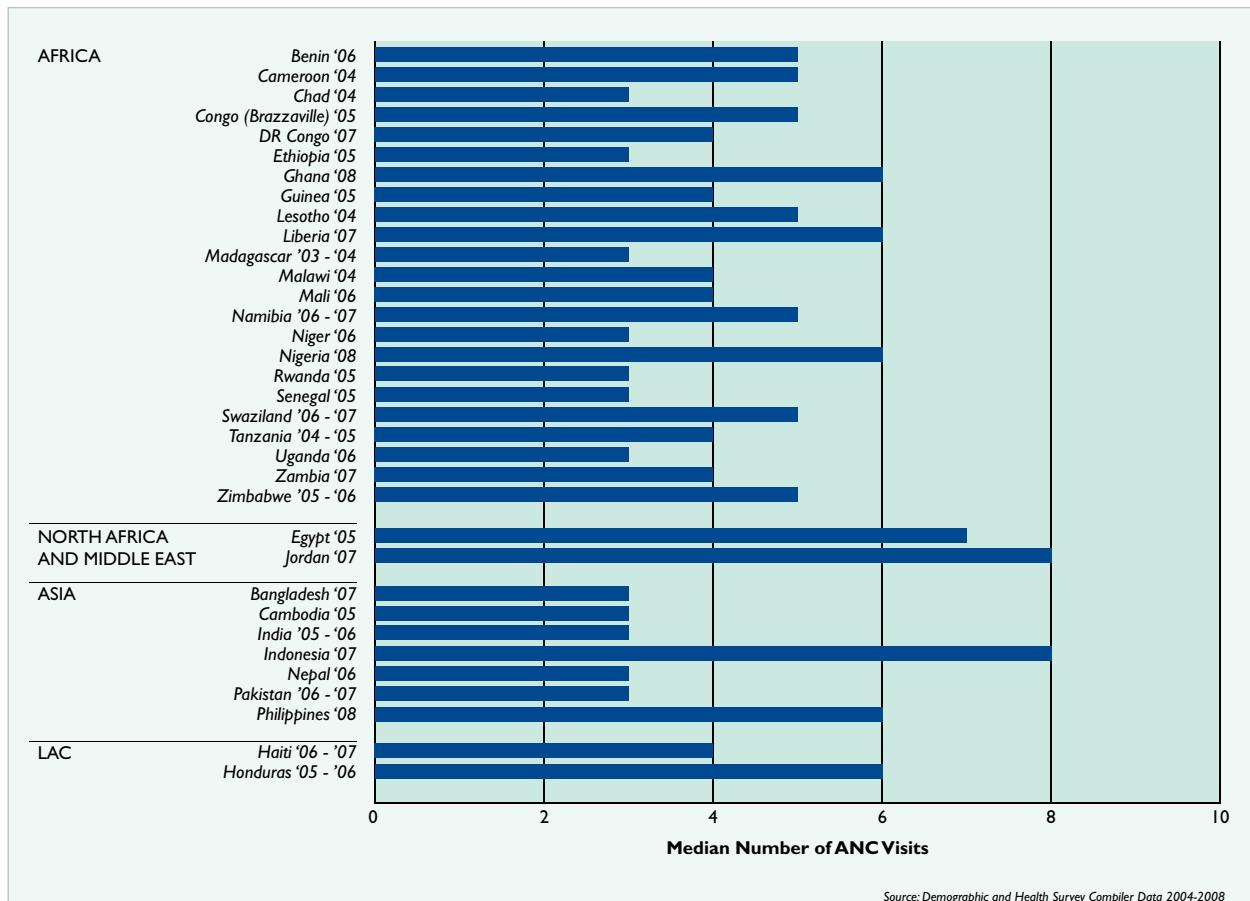
**Figure 10** (and **Appendix 5**) displays the median gestational age in months at first ANC visit among women who had a live birth in the five years preceding the DHS survey. Overall, only 11 of the 34 countries examined had a median gestational age at first ANC visit within the first trimester of pregnancy, which conforms with WHO's recommendation. In Africa, only four countries met this criteria (Congo, Ghana, Liberia and Senegal), but the remaining 16 did not. In 11 African countries the median age of first ANC visit was well into the second trimester of pregnancy (i.e. gestational age of 5 or more months). Women in Egypt and Jordan reported attending their first ANC visit by two months of age. In Asian countries the median age for a first ANC visit varied from a low of two months in Indonesia to a high of five months in Cambodia and Bangladesh. Women in both Haiti and Honduras had their first ANC visit within their first trimester of pregnancy.

Figure 10. Median gestational age at first ANC visit, DHS 2003–2008



**Median number of ANC visits.** In 22 of the 34 countries examined, the median number of ANC visits for pregnant women was four or more. The highest median number of ANC visits per pregnancy were in Jordan and Indonesia (8 visits), Egypt (7 visits) and Ghana, Liberia, Nigeria, Philippines and Honduras (7 visits) (**Figure 11** and **Appendix 5**). Twelve countries fell below the recommended 4 ANC visits per pregnancy, and these included Chad, Ethiopia, Madagascar, Niger, Rwanda, Senegal, Uganda, Bangladesh, Cambodia, India, Nepal and Pakistan. Surprisingly, half of the pregnant women in Nigeria had 6 or more ANC visits despite having their first ANC visit 5 months into their pregnancy.

Figure 11. Median number of ANC visits, DHS 2003–2008



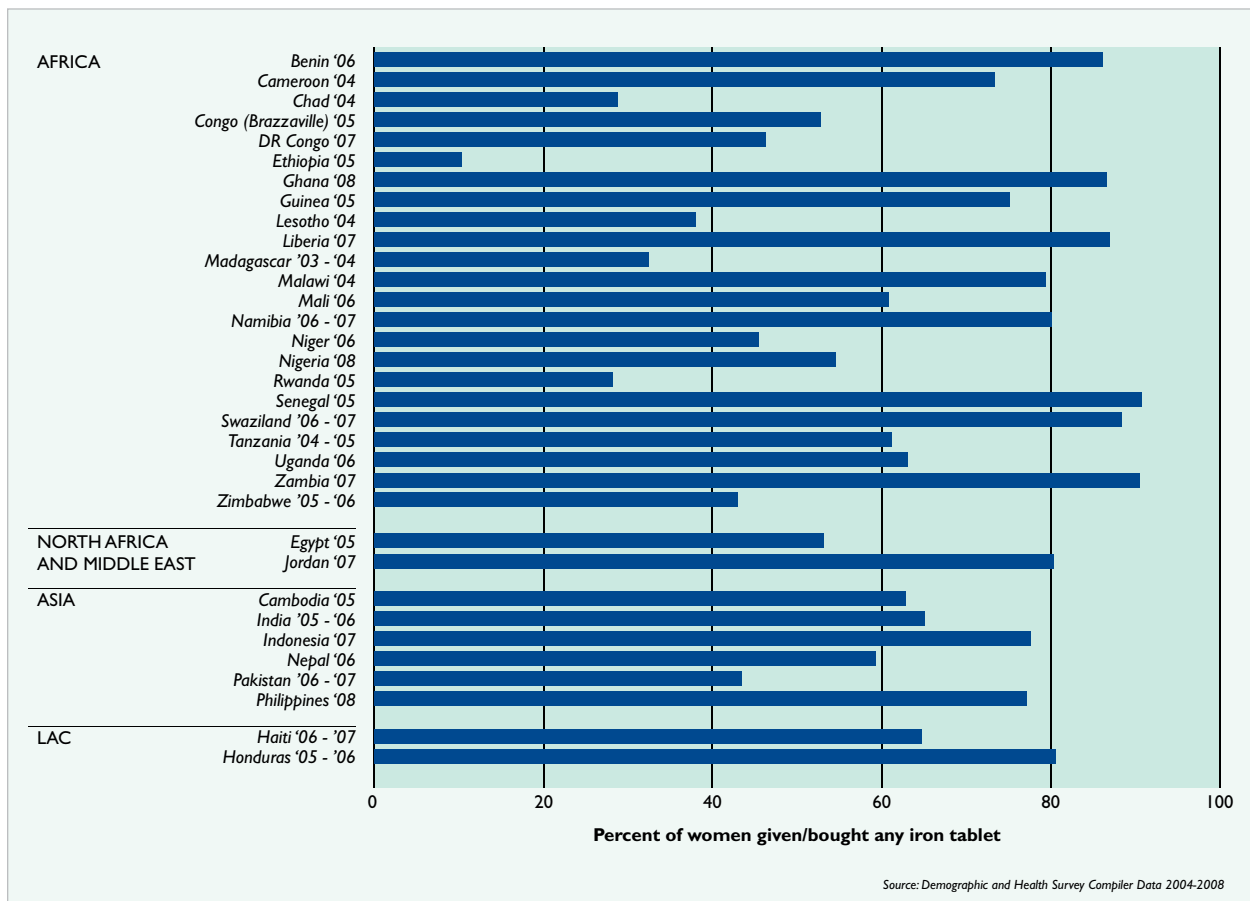
### 3.4 IRON SUPPLEMENTATION IN PREGNANCY

The high physiological demand for iron in pregnancy is hard to meet through dietary intake of iron-rich foods alone. Therefore, WHO recommends that pregnant women routinely receive iron supplements for six months during pregnancy in areas where iron deficiency is a public health problem.

#### *Proportion of women receiving or buying any iron tablets or syrup in pregnancy.*

The proportion of women receiving any iron tablets or syrup during their last pregnancy varied substantially within each region. In Africa, iron supplement purchase or receipt ranged from a low of 10.4 percent in Ethiopia to a high of ~91 percent in Senegal and Zambia (**Figure 12** and **Appendix 7**). In eight African countries, fewer than 50 percent of women had received or bought any iron tablets or syrup in their last pregnancy. Wide differences in iron supplement receipt were also evident in North Africa with Egypt reporting 53.1 percent and Jordan reporting 80.3 percent, and in Asia where iron receipt ranged from a low of 43.5 percent in Pakistan to a high of 77.6 percent in Indonesia.

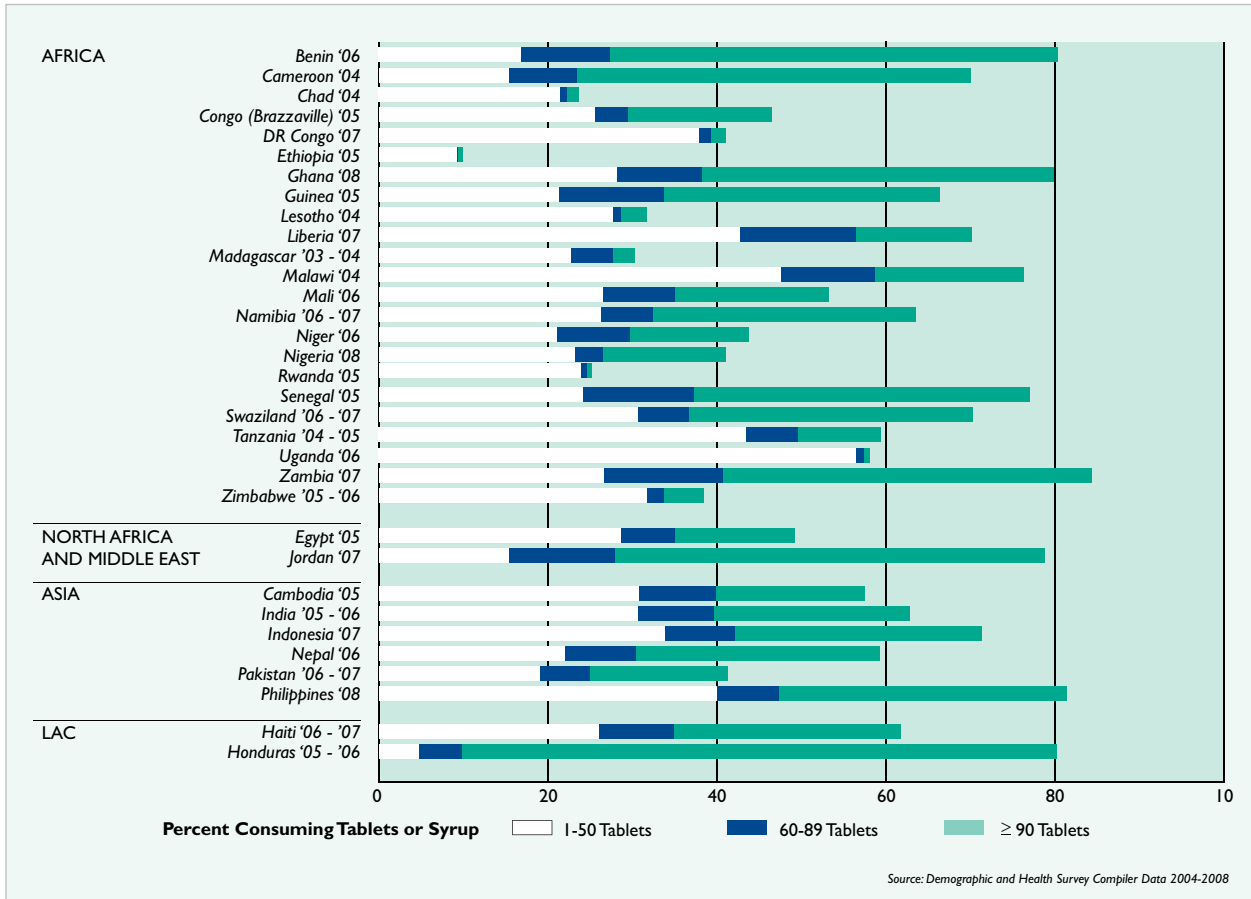
Figure 12. Percent of women who were given or bought any iron tablets or syrup in last pregnancy, DHS 2003–2008



Among women who reported being given or purchasing iron tablets, we examined the proportion who said they consumed iron tablets for zero days and assumed that this difference implied that the women had received iron tablets or syrup but chose not to consume them. On average, only about four percent of women who received iron supplements reported not taking them, although this proportion varied from a low of less than one percent in seven countries to a high of 16–18 percent in Namibia, Liberia, and Swaziland (**Appendix 7**). This suggests that most women, if provided with iron tablets or syrup of a reasonable quality, are likely to take them.

***Proportion of women taking iron tablets or syrup during pregnancy.*** WHO recommends providing iron tablets or syrup to pregnant women for six months during pregnancy in developing countries where iron deficiency is likely to contribute a major proportion of anemia in pregnancy. **Figure 13** (and **Appendix 7**) depicts the proportion of women who reported taking iron tablets or syrup for 1–59, 60–89 or 90 or more days during their last pregnancy. Variability across countries was high even among countries where 80 percent or more women take some iron. Take, for example, the countries of Benin, Ghana, Zambia, Philippines and Honduras. The proportion consuming 1–59 tablets varies from a low of 4.7 percent in Honduras and a high of 40.0 percent in the Philippines. Only three countries (Benin, Jordan, and Honduras) out of the 33 examined reported more than 50 percent of women consuming 90 or more iron supplements during their recent pregnancy.

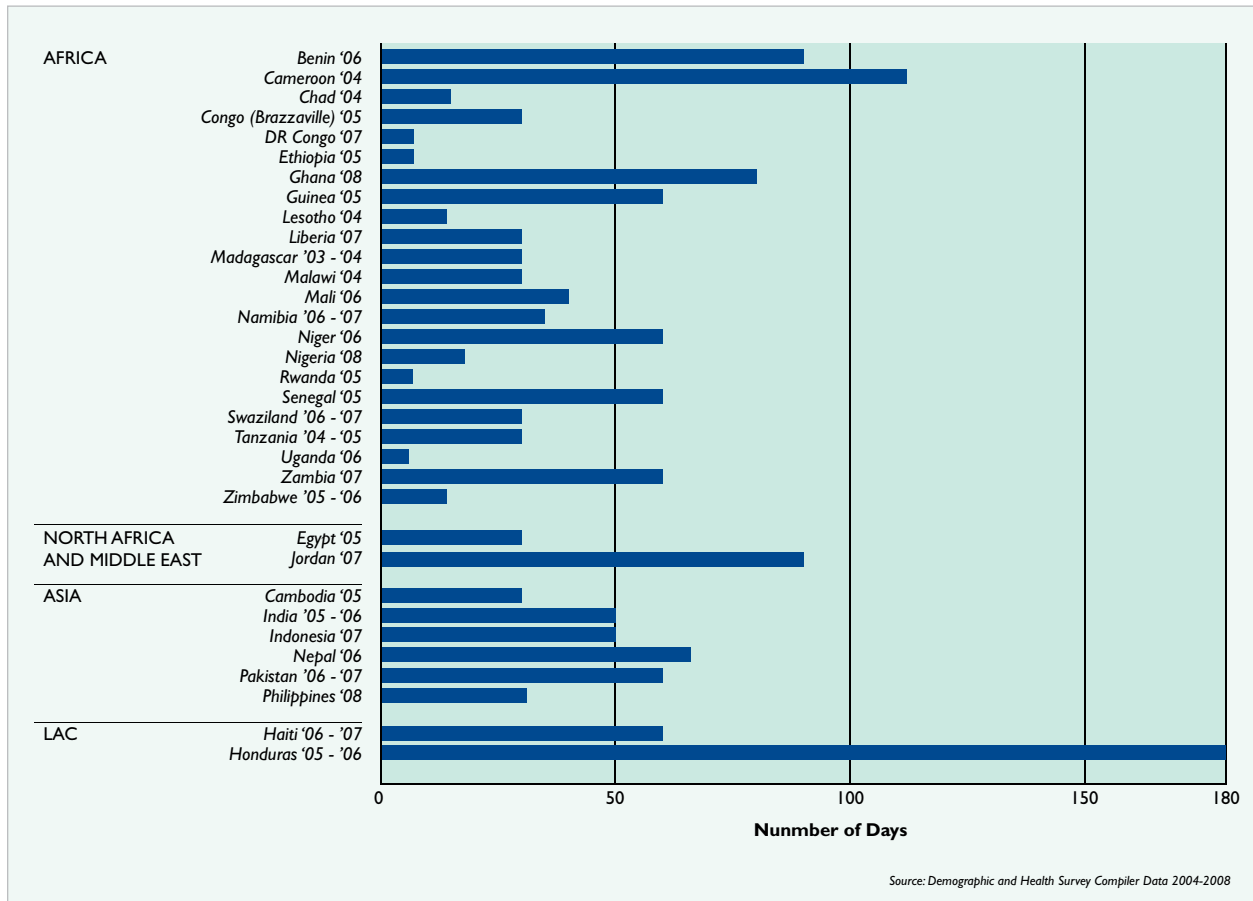
Figure 13. Percent of women taking iron for 1–59, 60–89 or 90 or more days during last pregnancy, 2003–2008



**Median number of days women took iron during their last pregnancy.**

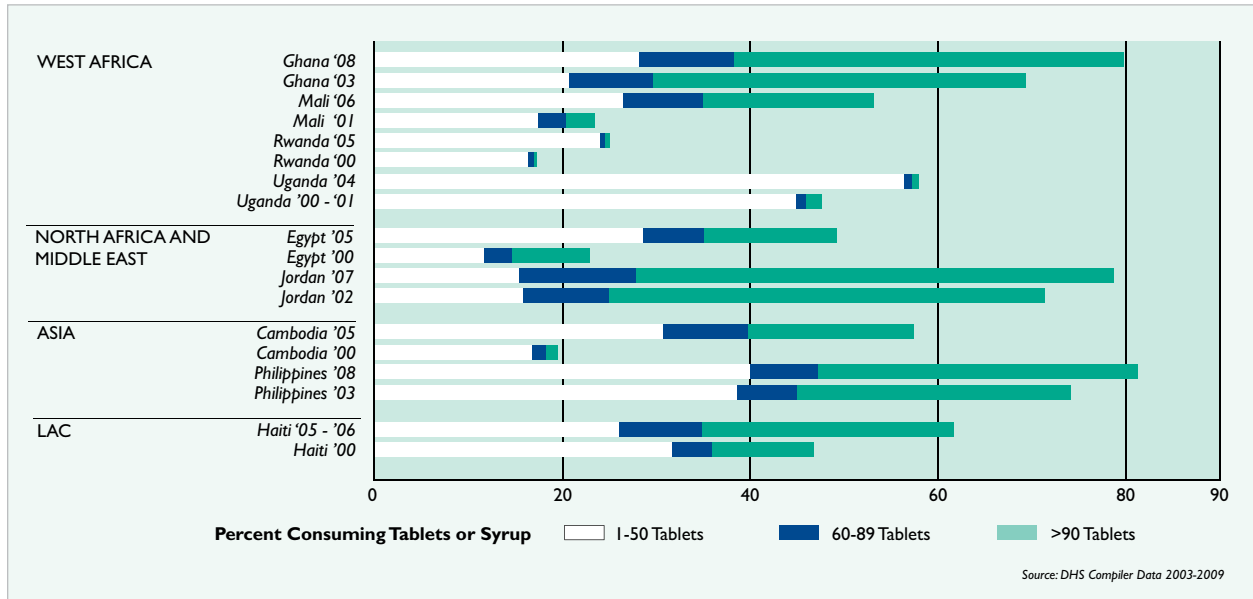
Figure 14 (and Appendix 7) presents the median number of days women reported taking iron tablets during the last pregnancy. Only one country (Honduras) met the WHO recommendation of six months or 180 days of iron supplementation, and only three other countries (Benin, Cameroon and Jordan) met half of this target (i.e. 90 days). The remaining 29 countries fell far short of the WHO recommendation, with 16 countries reporting a median of 30 or less days of iron supplement consumption.

Figure 14. Median number of days iron tablets or syrup taken during last pregnancy, DHS 2003–2008



*Changes over five years in the proportion of women taking iron 1–59, 60–89 and 90 or more days during the last pregnancy.* **Figure 15** (and **Appendix 8**) depicts changes in the percentage of women taking iron supplements for 1–59, 60–89, and  $\geq 90$  days during their last pregnancy over two consecutive DHS surveys. In all countries the proportion of pregnant women who reported taking any iron supplements increased, and the absolute increase ranged from 7.2 percent in the Philippines to 37.9 percent in Cambodia. However, despite the size of these overall increases, the proportion of women consuming 90 or more tablets hardly changed in Ghana, Rwanda, Uganda, Jordan and the Philippines. In contrast, much larger changes in the proportion of women consuming 90 or more iron supplements were observed in Cambodia, Mali, and Haiti.

Figure 15. Change over five years in percent of women taking iron tablets or syrup for 1–59, 60–89, or 90 or more days during the last pregnancy, DHS 2000–2008



### 3.5 CORRELATION BETWEEN ANC USE AND IRON SUPPLEMENTATION IN PREGNANCY

**Table 3** displays the correlation coefficients for variables characterizing country-specific estimates of ANC use and iron supplementation based on 33 countries for which data were available. There was a positive but moderate correlation between countries with higher ANC coverage and higher iron tablet receipt ( $p=0.63$ ) and consumption ( $p=0.64$ ). Similarly, higher frequency of ANC visits in countries was positively, but weakly, associated with higher iron tablet consumption ( $p=0.40$ ). There was a weak negative correlation between the gestational age of the first ANC visit and both the proportion of women consuming iron tablets ( $\rho=-0.43$ ) and number of tablets consumed ( $\rho=-0.54$ ). In other words, in countries where ANC visits occurred earlier in pregnancy, more women took iron tablets and they took a higher number of tablets. Finally, there was a weak to moderate correlation between the proportion of women buying/being given iron or consuming iron in a country and the median number of days that women consumed iron tablets ( $\rho=0.51$  and  $\rho=0.63$ , respectively). Surprisingly, there was no statistically significant correlation between the median number of ANC visits in a country and number of days women consumed iron tablets.

Table 3. Correlation coefficients ( $\rho$ ) of country-specific estimates of ANC and iron tablet use during pregnancy

	% women with $\geq 1$ ANC visit	Median no. ANC visits	GA of first ANC visit, months	% women given/bought any iron tablets	% women who took any iron tablets	Median no. days iron tablets taken
% women with $\geq 1$ ANC visit	1.00					
Median No. ANC visits	0.38	1.00				
GA at first ANC visit, months	-0.15	-0.62	1.00			
% women given/bought any iron tablets	0.63	0.43	-0.40	1.00		
% women who took any iron tablets	0.64	0.40	-0.43	0.97	1.00	
Median No. days iron tablets taken	0.21	0.28	-0.54	0.51	0.63	1.00

GA = Gestational Age

ANC = Antenatal Care

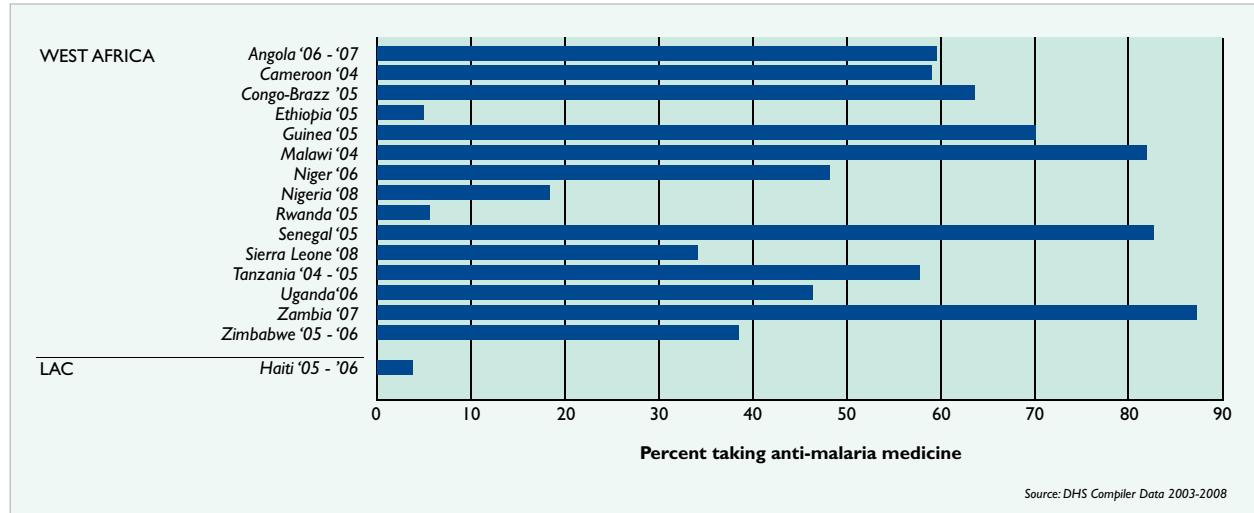
### 3.6 PREVENTION AND TREATMENT OF MALARIA DURING PREGNANCY

Malaria infection in pregnancy poses a substantial risk to the mother, the fetus, and the newborn infant. Pregnant women are less capable of coping with and clearing malaria infections. Research has shown that intermittent preventive treatment (IPT) of malaria with sulfadoxine-pyrimethamine (SP) during pregnancy can reduce maternal anemia, clear placental parasitemia and reduce low birth weight in infants<sup>32,33,34</sup> although increasing levels of parasite resistance may jeopardize the benefits of national IPT-SP programs in sub-Saharan Africa. The usual protocol is to provide an initial dose of sulphadoxine (500 mg) and pyrimethamine (25 mg) during the second trimester and a second dose during the third trimester.

**Percent of women who took an anti-malarial during their last pregnancy.** Wide variability exists across Africa in the proportion of women taking any anti-malarials during pregnancy ranging from a low of five percent in Ethiopia to a high of 87 percent in Zambia (**Figure 16** and **Appendix 9**). The variability may, in part, be explained by different levels of malaria endemicity in each country. For example, only a small

portion of Ethiopia and Rwanda are considered endemic for malaria, while high proportions of the other sub-Saharan African countries are considered endemic. In Niger and Zimbabwe malaria is endemic in large regions but not across the entire country. In the countries where malaria endemicity is high and covers most if not all the country, a high proportion of pregnant women are at risk for malaria because they did not take or were not reached by IPT with SP.

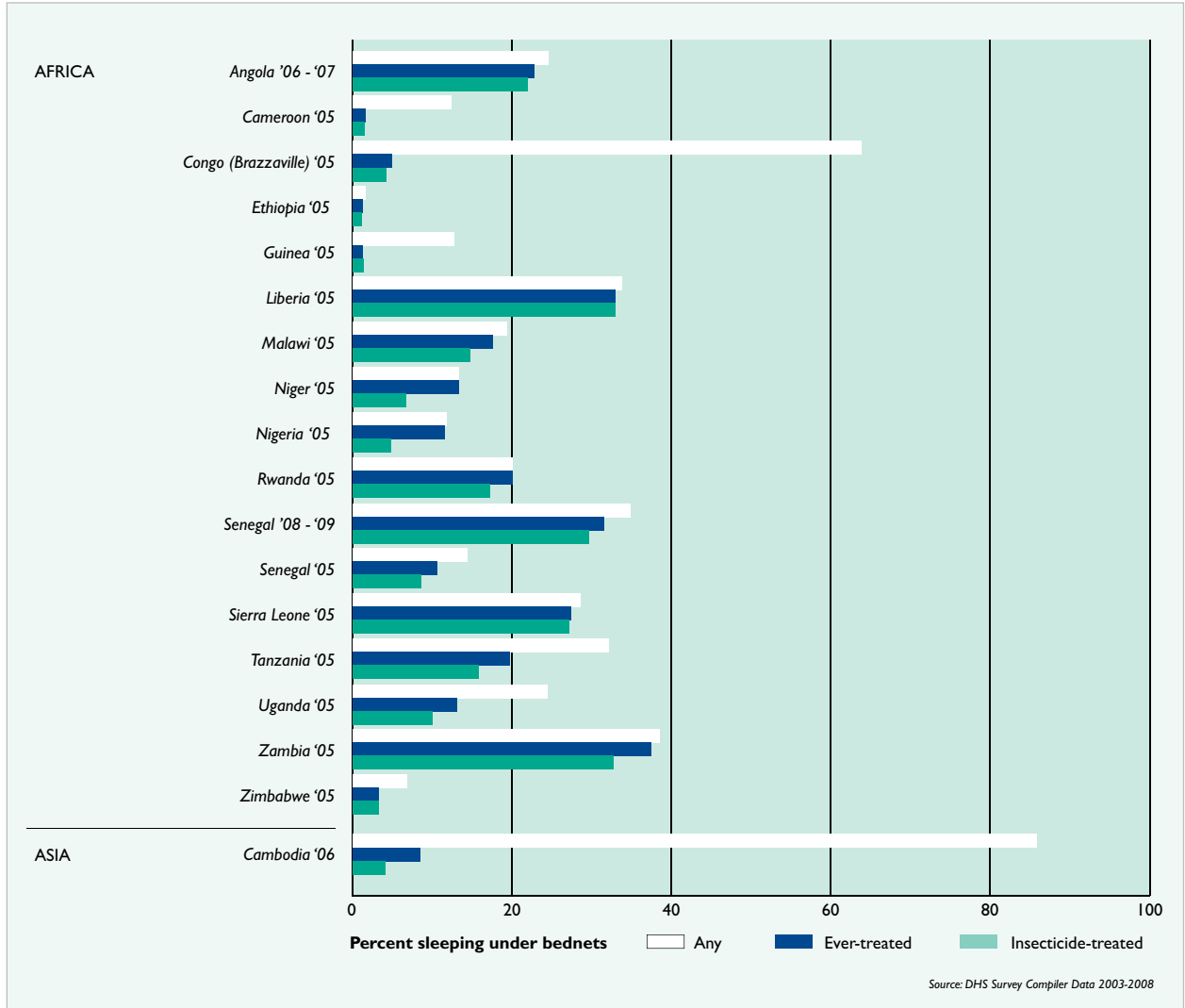
Figure 16. Percent of pregnant women who took an anti-malaria medicine during their last pregnancy, DHS 2003–2008



**Proportion of pregnant women sleeping under insecticide-treated mosquito nets (ITNs).**

Protection with ITNs during pregnancy is widely advocated. ITNs have a beneficial impact on pregnancy outcomes in malaria-endemic regions of Africa when used by communities or by individual women. **Figure 17** (and **Appendix 10**) displays the distribution of mosquito net use among pregnant women by country disaggregated by type of net (i.e. any net, ever-treated net and ITN). The proportion of pregnant women who slept under any bednet was less than 40 percent in all African countries examined, with the exception of Congo-Brazzaville. In Senegal, Malawi, Rwanda, Angola, Sierra Leone, Liberia and Zambia, while a while a minority of women slept under a mosquito net, those who did mostly slept under an ITN. In contrast, fewer than half the women sleeping under mosquito nets were using an ITN in Uganda, Tanzania, Congo-Brazzaville, Zimbabwe, Nigeria, Cameroon, Guinea, and Niger. The pattern of mosquito net use for non-pregnant women closely resembled that of pregnant women (data not shown).

Figure 17. Percent of pregnant women who slept under a mosquito net in the last night by type of bednet, DHS 2003–2008

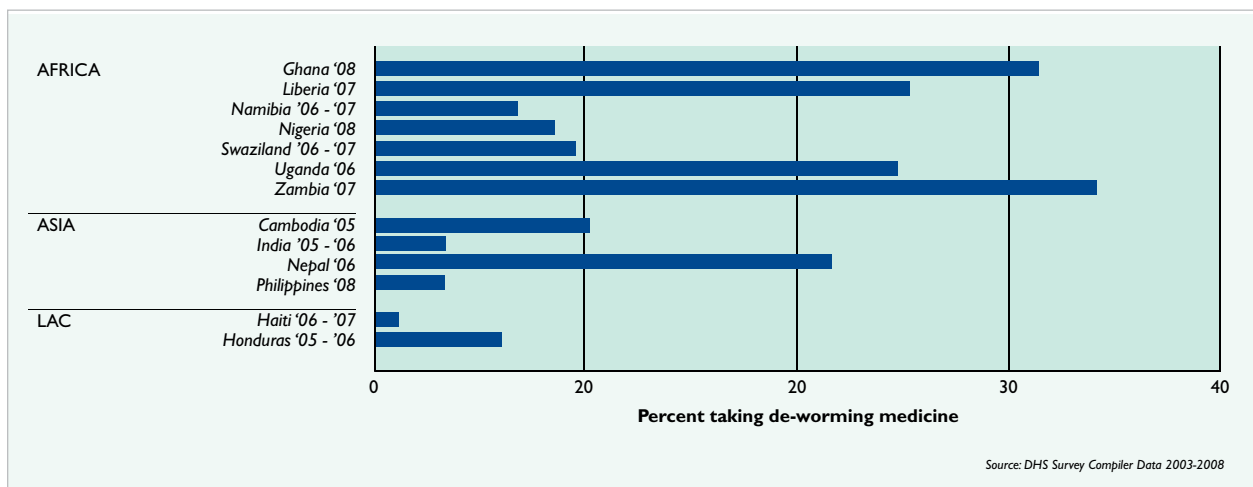


### 3.7 DE-WORMING MEDICATION DURING PREGNANCY

Helminthiasis is an infestation of the human body with parasitic worms and globally it is estimated to affect 44 million pregnant women each year. Intestinal helminthiasis is associated with blood loss and decreased supply of nutrients for erythropoiesis, resulting in iron deficiency anemia. Helminth infections during pregnancy may be associated with adverse outcomes, including maternal anemia, low birth weight, and perinatal mortality. Hookworm infestation is a major contributing cause of anemia in women of reproductive age in endemic areas. De-worming during pregnancy has therefore been strongly advocated.

**Figure 18 (and Appendix II)** shows the proportion of women who reported taking de-worming medicine during her last pregnancy. In Africa, the highest pregnancy de-worming coverage was in Zambia (38%), followed by Ghana (35%), Liberia (28%), and Uganda (27%). The remainder of sub-Saharan countries surveyed had 11 percent or lower coverage. In Asia, Nepal exhibited the highest coverage (24%) with India and the Philippines displaying the lowest coverage (4%).

Figure 18. Percent of women taking a drug for intestinal worms in last pregnancy, DHS 2003–2008





## 4.0

# Examples of Preliminary Policy and Program Assessments for Maternal Anemia Prevention and Control in Three A2Z Focus-Countries: Uganda, India, and the Philippines

## 4.1 THE A2Z PROJECT

---

A2Z: The USAID Micronutrient and Child Blindness Project is USAID's flagship vehicle to consolidate, build on, and expand USAID's leadership in micronutrients, child survival, and overall nutrition. In 2008, A2Z supported a process to review critically the performance and effectiveness of large-scale micronutrient programs, including maternal iron and folic acid (IFA) supplementation. The review identified barriers to effective implementation of large-scale maternal IFA supplementation programs. These barriers included: (1) inadequate political support, (2) low priority for IFA within maternal health programs, (3) insufficient bundling of interventions to address the multiple causes of anemia, (4) inadequate supplies, low utilization, and weak demand, (5) lack of convincing evidence of effective program implementation, and (6) the lack of community-based delivery platforms for maternal IFA supplementation to complement the clinic-based antenatal services.

A2Z developed and pursued a two-pronged strategy—global and country-level—to address the program constraints above. By partnering with global and regional networks (such as CORE Group, White Ribbon Alliance [WRA], Africa 2010) and USAID-funded health projects, A2Z has provided global advocacy on maternal anemia to key global and regional stakeholders (White Ribbon Alliance, CORE Group of PVOs, ECSA Ministerial Conference, Women's Delivery Conference, Global Maternal Health Conference) and catalyzed and invigorated awareness and action to reduce maternal anemia. To address the need for increasing the evidence-base for effective maternal anemia programs, A2Z has worked with country programs in India (Jharkhand and Uttar Pradesh), Uganda, Philippines, and Cambodia to

overcome implementation obstacles, develop country-specific tools, and document program performance and effectiveness. This has involved policy reviews and revisions, strengthening supply chain management (for iron and folic acid tablets, de-worming and anti-malaria medicines), building health worker capacity (through health worker training programs, job aids, etc.), designing demand generation strategies (using interpersonal, print and mass media channels), and monitoring program performance. Detailed documentation of strategies and tools developed and used as part of the A2Z project can be found on the A2Z website (<http://www.a2zproject.org/>)

A2Z developed the “Maternal Anemia Policy and Program Assessment Guideline” below (**Table 4**). It provides a framework to assess, clarify, and summarize information on elements of program components thought to be essential for effective maternal anemia prevention and control programs. This framework follows a “program model” that maps out how program inputs are expected to lead to intended outcomes, and identify factors that may affect the intermediate steps along the way. A first step involves assessing the degree to which each program component is adequately supported and implemented. This should be based on valid evidence, contextual knowledge and experience of each program component. Epidemiologic data on the extent, severity, causes, and distribution of anemia in women can assist program managers to determine the best mix and targets for interventions. Data on access, availability, use and quality of current interventions at different program implementation levels (e.g. national, district, community, women) can help identify program implementation gaps and inform corrective action. Readers interested in learning more about designing a participatory workshop that aims to strengthen the analysis and decision-making processes related large-scale micronutrient interventions are referred to the Program Assessment Guide available from the A2Z website (<http://www.a2zproject.org/pdf/PAG.pdf>).

Table 4. Maternal anemia policy and program assessment guideline

Program Component	Indicator/Information
Policy	<ul style="list-style-type: none"> <li>• Does a written iron and folic acid supplementation national policy/protocol exist? If so, describe treatment/prevention protocols (e.g. target groups, recommended IFA supplementation dose, frequency and duration by target group).</li> <li>• Does a written national policy/protocol exist for malaria and/or hookworm prevention and treatment? Please describe contents.</li> </ul>
Political Support	<ul style="list-style-type: none"> <li>• Is anemia reduction mentioned in existing country nutrition and/or development plans? If so, what are the goals and strategies described in the plan?</li> <li>• Do country-level working groups or committees meet whose mandate includes anemia reduction? If so, what is the mandate, authority and composition of the committee? What evidence exists, if any, of its functionality and performance?</li> </ul>

Table 4. Maternal anemia policy and program assessment guideline (continued)

Program/ Intervention Description	<ul style="list-style-type: none"> <li>• Are key anemia reduction interventions being implemented in the country? For each, intervention, describe the key elements: <ul style="list-style-type: none"> <li>• Iron and folic acid supplementation: service delivery platform used; who gives the IFA; dose and form of IFA; frequency and platform of IFA distribution.</li> <li>• Malaria: describe presumptive treatment platform and distribution of insecticide treated bednets; who distributes, how often.</li> <li>• De-worming: service delivery platform used to distribution de-worming tablets.</li> </ul> </li> </ul>
Logistics	<ul style="list-style-type: none"> <li>• Do standards for IFA tablets (dose, form, packaging) exist for target groups? If so, describe them.</li> <li>• Do national/regional/district/ guidelines exist for estimating IFA supplement supply, and procurement, requisitioning and re-supply procedures? If so, describe them.</li> <li>• Do procedures exist for monitoring adequacy of IFA supplement supply at storage and distribution points? If so, describe them.</li> <li>• Do data exist on number and proportion of clinics or IFA supplement distribution points with no “stock outs”? How regularly is this collected? How are these data used?</li> </ul>
Training	<ul style="list-style-type: none"> <li>• Do health worker training manuals and programs include essential information on how to implement the national maternal anemia interventions? If so, describe these.</li> </ul>
Behavior Change Communication	<ul style="list-style-type: none"> <li>• Are data available from formative research that identifies primary barriers for IFA adherence in pregnancy?</li> <li>• Do local communication materials exist addressing primary barriers to IFA adherence?</li> </ul>
Monitoring	<ul style="list-style-type: none"> <li>• Describe the IFA monitoring system.</li> <li>• Is receiving IFA included on ANC card? Is ANC attendance monitored? Are IFA coverage indicators included in the health management information system? What are the levels of ANC attendance and IFA coverage from the existing monitoring systems?</li> </ul>
Demand Creation	<ul style="list-style-type: none"> <li>• Describe demand generation strategies that exist related to maternal anemia interventions? What do they promote (ANC participation? IFA adherence?)?</li> <li>• Describe community mobilization strategies, if any, used to promote using maternal anemia reduction interventions?</li> <li>• How are community-based health workers involved in maternal anemia reduction interventions?</li> </ul>

The following pages are examples of preliminary assessments of maternal anemia prevention and control programs for three A2Z project focus-countries—Uganda, India and Philippines. The information was collected and organized into the assessment framework by A2Z representatives from each respective country. It can serve as a starting point for more in-depth analysis of program strengths and weaknesses, and aid in developing a plan of action for improving the program components and the performance of the relevant interventions.

## 4.2 UGANDA

Anemia is a critical public health problem in Uganda, affecting 64 percent of pregnant and 49 percent of non-pregnant women.<sup>35</sup> The Government of Uganda is implementing maternal anemia interventions through the national health system, using the ANC platform to deliver a range of interventions that include IFA supplementation, de-worming and preventing malaria in pregnancy using IPT and long lasting insecticide-treated bednets.

Although ANC coverage for at least one visit is high (94%), the first ANC visit occurs quite late in the pregnancy (median gestational age at first visit is five months) and the frequency of visits (median number is three) is less than the recommended minimum number of four.<sup>35</sup> In

addition, the coverage and reach of interventions that depend on clinic-based ANC services are low, due to unreliable availability of supplies and infrequent and/or late use of ANC services.

One obstacle to providing improved maternal nutrition services is lack of adequate information among health service providers to counsel pregnant and lactating women on how to meet increased nutritional requirements through dietary

and behavioral changes and healthcare-based services. A2Z works at national and district levels through the MOH and other partners to strengthen systems for improved delivery of proven maternal anemia interventions. A2Z supported developing tools and advocacy materials that include a maternal nutrition guideline, and built the capacity of district operational level health workers through refresher training on counseling of pregnant women and management of supplies.



Table 5. Maternal anemia policy and program assessment guideline, Uganda

Problem Component	Indicator/Information
Policy	In Uganda, anemia reduction is cited in the Health Sector Strategic Plan III as one way to strengthen maternal nutrition to ensure good pregnancy outcome and healthier infants. Anemia reduction strategies include providing IFA to pregnant and lactating women and promoting iron rich food consumption. IFA for adolescent girls is included in the strategy; but has not yet been implemented. Policies on malaria and de-worming for pregnant women aim to reduce maternal anemia.

Table 5. Maternal anemia policy and program assessment guideline, Uganda (continued)

Political Support	<p>The Ministry of Health's Maternal and Child Health (MCH) Cluster is a national level working group that meets monthly to address maternal anemia and other MCH issues. The MoH Technical Working Group on Nutrition also addresses maternal anemia issues. This multi-stakeholder group—including other nutrition partners such as NGOs, UNICEF, and WHO—feeds into the MCH Cluster and meets on an ad hoc basis to respond to MOH.</p>
Program/ Intervention Description	<p><i>IFA supplementation.</i> Uganda's national policy specifies that pregnant and lactating women should receive IFA supplements. The tablets contain 200 mg ferrous sulphate (60 mg elemental iron) and 5 mg folic acid. The national protocol recommends that women take one tablet daily for 6 months during pregnancy (a total of 180 tablets) and for 3 months after delivery (an additional 90 tablets). The IFA tablets are provided through nurses and midwives in ANC clinics. Women are given a 30-day supply at a time. The iron folic acid tablets are counted out to clients in the ANC clinics from tins containing 1000 tablets. Different packaging, including blister packs, is available in the private sector.</p> <p><i>Malaria prevention and treatment.</i> Uganda, where most of the population is at risk of exposure to malaria caused by plasmodium falciparum, has a national policy for intermittent preventive treatment of malaria during pregnancy using SP. Nurses and midwives give pregnant women one dose in the second trimester and another dose in the third trimester by directly observed therapy. The national protocol also specifies treating uncomplicated and complicated malaria. Sleeping under ITNs, including long-lasting insecticidal nets (LLINs) that do not require frequent re-treatment with insecticides, can effectively reduce malaria risk. ITN/LLIN distribution in Uganda varies; usually district health authorities distribute nets sometimes in collaboration with NGOs and/or community leaders. Distribution is done through ANC clinics and sometimes directly to households, targeting those with pregnant women and children under five. No fixed distribution schedule exists. Distributing ITNs/LLINs is often more frequent in areas with internally displaced persons.</p> <p><i>De-worming.</i> A national protocol for preventing and treating hookworm exists in Uganda. Routine de-worming is recommended during the second and third trimesters of pregnancy and is offered in ANC clinics by nurses or midwives using a directly observed therapy approach. Environmental hygiene is encouraged to prevent hookworm infestation.</p>
Logistics	<p>Supply needs are determined by the health facilities and districts based on their projected population, consumption in the last time period, and stock levels at the time of requisitioning. Supplies are requisitioned every month using standardized forms. At the national level, procuring IFA depends on demand from the districts. Stock cards can aid in monitoring stock levels and adequacy of supplies. However, the stock cards are not updated on a regular basis at the health facilities in part because health workers are overloaded with too many tasks. Currently, routine monitoring of facilities and districts is not conducted to determine whether some experience stock-outs although this information could potentially be extracted from stock cards.</p>
Training	<p>The MOH, working with A2Z, has developed training manuals for maternal anemia that have been used in A2Z-supported districts. These manuals include assessing and treating maternal anemia, instructions on nutrition counseling, and medicine supply management at the health facility level.</p>

Table 5. Maternal anemia policy and program assessment guideline, Uganda (continued)

Behavior Change Communication	No information exists on formative research that identifies primary barriers for adherence to prescribed iron folic acid supplementation in pregnancy. No communication materials address primary barriers to IFA adherence.
Monitoring	<p>No specific system for monitoring IFA exists. As an ANC-based service, information regarding IFA is available from ANC registers, which includes ANC attendance and number of women who receive IFA tablets. IFA supplementation is recorded on the woman's ANC card. Further information regarding availability of IFA at health facilities is available from stock cards; however, this information is not routinely summarized and reported.</p> <p>ANC attendance is monitored from ANC registers and compared with population catchment areas. IFA indicators are not included in the health management information system (HMIS); however, the current HMIS review process has proposed that IFA information should be included. Based on information from the Uganda DHS 2006, 47 percent receive at least four visits and only 0.7 percent receives 90+ IFA tablets.</p>
Demand Creation	No specific demand creation strategies target maternal anemia interventions beyond encouraging pregnant women to use ANC services. Mobilization strategies target ANC services in general, which also includes maternal anemia reduction. The most common channels are radio messages. Community health workers do not yet participate in maternal anemia interventions. However, the community health worker manual (recently developed but not yet operationalized) includes maternal anemia messages.

### 4.3 INDIA

In India, despite decades of interventions designed to combat maternal anemia, prevalence reported by the National Family Health Survey increased from 49.7 percent in 1998–1999 to 58.7 percent in 2005–2006 among pregnant mothers. The inability to reduce anemia prevalence among pregnant mothers in India raised doubts of program effectiveness. It also led to recognizing problems regarding IFA supplementation such as: lack of awareness about the importance of IFA supplementation and fear of a complicated delivery when IFA is consumed as recommended, non-compliance with recommended regimens, side effects such as gastrointestinal irritation,



poor quality and packaging of IFA tablets, limited or no availability of IFA supplements, the low status of women in society and their consequent lack of decision-making power, mobility and other factors. A2Z is working in Jharkhand and Uttar Pradesh to address barriers to effective interventions.

Table 6. Maternal anemia policy and program assessment guideline, India

Problem Component	Indicator/Information
Policy	<p>India has a written national policy to reduce nutritional anemia and a National Anemia Control program. The nutritional anemia chapter of the current Five Year Plan included the following targets: (i) universal screening of pregnant women for anemia and appropriate treatment; and (ii) reducing the prevalence of anemia by 25 percent and moderate and severe anemia by 50 percent in children, pregnant and lactating women and adolescents. Some states are considering a policy that recommends using intravenous iron for pregnant mothers with severe anemia; however, this has not yet been implemented.</p>
Political Support	<p>The reduction of nutritional anemia is mentioned in the 10th and 11th Five year plan document. Goals include (i) Universal screening of pregnant women for anemia and appropriate treatment and (ii) reducing the prevalence of anemia by 25 percent and moderate and severe anemia by 50 percent in children, pregnant and lactating women and adolescents.</p>
Program/ Intervention Description	<p><i>IFA supplementation.</i> The national treatment protocol specifies that pregnant women should receive one adult tablet per day for 100 days during pregnancy. Each tablet, named Folifer, contains 100 mg of elemental iron and 500 µg folic acid. Postpartum women, including those who are breastfeeding and intra-uterine device (IUD) acceptors, should receive one adult IFA tablet for an additional 100 days. Because tea inhibits iron absorption, it is recommended that drinking tea should be avoided within a few hours of taking Folifer.</p> <p>The strategy described in the Nutritional Anemia Prevention Programme includes: (i) promoting regular consumption of foods rich in iron; (ii) providing IFA supplementation in the form of tablets to high-risk groups; (iii) identifying and treating severely anemic cases. The program is implemented through Primary Health Centers (PHCs) and their sub-centers. The female multiple purpose worker and other paramedical workers at the PHC distribute iron tablets to pregnant and lactating women, IUD users, and children aged one to five years. The functionaries of Integrated Childhood Development Services (ICDS) Program, under the Department of Women and Child Development, assist in distributing iron tablets to children and mothers in the ICDS blocks and in educating mothers on preventing nutritional anemia. The Department of Food (Ministry of Food and Civil Supplies) promotes iron rich food consumption. In addition, effective program implementation recommends using community workers and involving formal and informal education, media, horticultural departments, and voluntary organizations.</p> <p><i>Malaria prevention and treatment.</i> The National Malaria Control program has no link to pregnancy care. When a pregnant woman has a fever, she is advised to get a blood smear and if positive for malaria parasites, she should be treated with a course of chloroquine (12 tablets). The program's strategy is early case detection and prompt treatment to prevent malaria transmission and chloroquine is the main anti-malaria drug for uncomplicated malaria. Drug distribution centers and fever treatment depots have been established in rural areas for easier access to anti-malaria drugs at the community level. The drug policy includes recommendations on alternative drugs for chloroquine-resistant malaria. For vector control, the program includes using (i) indoor residual spraying with insecticides, (ii) chemical larvicides, and (iii) larvivorous fish in ornamental tanks and fountains. Sleeping under an ITN/LLIN and screening houses with wire mesh are recommended as actions that individuals can take. The community can contribute to malaria control by identifying and eliminating mosquito breeding places. Monitoring malaria control activities includes a monthly Computerized Management Information System, field visits by State National Program Officers, field visits by Malaria Research Centers and other Indian Council of Medical Research (ICMR) Institutes, and feedback to states on field observation actions.</p> <p><i>De-worming.</i> In India, no national policy exists on hookworm control prophylaxis program for pregnant women. Those who present to health facilities or providers with complaints consistent with intestinal worms get treated.</p>

Table 6. Maternal anemia policy and program assessment guideline, India (*continued*)

Logistics	<p>The Government of India (GOI) gets IFA tablets through its procurement wing either at central or state level. Standards for IFA tablets (including dose, form, and packaging) are specified in government procurement bids.</p> <p>GOI procures a reproductive and child health kit containing 15,000 IFA tablets. Each Kit is intended to serve an area with a population of approximately 5000, the size originally covered by a sub-center (the population covered by each sub-center is now much more than 5000). The centrally purchased IFA tablets are sent (by “push mechanism”) to every district according to the number of sub-centers in each district.</p> <p>Before procuring kits, GOI asks states to estimate the number of kits required; however, states are guided to send a number calculated on the assumption that the population is still 5000 per sub-center. Close follow-up has revealed to A2Z that states can ask for—and receive—more kits than the calculation based on 5000 population per sub-centers; however, not all states are aware of this fact. States are also allowed to procure IFA from their own funds because either supply is inadequate or has not arrived in time. IFA kits are supposed to be supplied every six months. In reality, large variations exist in delivery and internal program evaluations have labeled procurement “weak.”</p> <p>The monitoring form now includes IFA. Effective use and reliability of the data are still weak. However, because of poor compliance, if the kits are supplied in time, stock-outs leading to non-availability rarely happen. Information is not collected regularly on health facility stock-outs.</p>
Training	<p>No separate training for anemia exists. Auxiliary nurse midwife and anganwadi worker training include anemia control among several other topics. The primary message is “every pregnant mother should be given 100 IFA tablets” after the first trimester of pregnancy. Emphasis on counseling and on IFA benefits for the mother and child is largely missing. Promoting institutional delivery is the priority area—with a monetary incentive for the health worker—and this takes a lot more time, energy, and attention than providing IFA, which gets low priority.</p>
Behavior Change Communication	<p>Formative research has identified primary barriers to IFA adherence in pregnancy.<sup>36</sup> The barriers identified include inadequate logistics, late and infrequent use of antenatal services, and a lack of awareness among pregnant women of the benefits of using ANC services and of reducing their anemia. The causes are associated with factors operating at the health systems, health worker, and client levels. The findings emphasize that urgent actions must be taken to improve logistics and health worker performance (“pull effect”), and to create demand among pregnant women for the ANC services (“push effect”). Some actions have been implemented to address these barriers, but further work is needed.</p>
Monitoring	<p>Anemia is measured in the National Family Health Survey and is included in regular monitoring of pregnant women at the Primary Health Centers; but this monitoring is not functional and little attention is paid to anemia control on a priority basis.</p> <p>A new HMIS format includes information on pregnant women registered for ANC, given 100 IFA, and their hemoglobin level. The report generated from the data is poor or does not exist.</p>

Table 6. Maternal anemia policy and program assessment guideline, India (continued)

Demand Creation	Demand generation activities related to maternal anemia do not exist at the national level. Messages for registering of pregnancy, however, are played on national radio and television. One spot that includes all pregnancy care, mentions 100 IFA (no further counseling, no mention of benefits). Community mobilization strategies to promote use of maternal anemia reduction interventions do not exist. Auxiliary nurse midwife and anganwadi workers are involved in all MCH activities; however, maternal anemia is not a focused topic.
-----------------	--

#### 4.4 PHILIPPINES

The severity and magnitude of anemia among pregnant women pose a significant public health issue in the Philippines. Successive National Nutrition Surveys reveal only slight decreases in maternal anemia prevalence since 1998—from 50 percent to 43.9 percent in 2003 to 42.5 percent in 2008. Prevalence rates are high in 9 of 16 regions in the Philippines. The anemia prevalence rate among lactating women, on the other hand, was significantly lower in 2008 at 31.4 percent, which corresponds to moderate magnitude and a decrease from the prevalence in 2003 of 42.2 percent. In the case of lactating women only 2 of 16 regions had a prevalence rate of more than 40 percent in 2008.

A2Z works to ensure 100 percent of US Government-assisted provinces procure IFA supplements for pregnant women. However, even if a line item exists for IFA procurement in provincial budgets, not all provinces procure iron tablets because they receive supplies from the Central Department of Health (DOH) and some NGOs. These externally supplied tablets may result in this line item being removed from provincial budgets and therefore may hamper sustainability if external supplies are reduced or terminated. A2Z has been working to build capacity within Centers for Health Development (formerly Regional Health Offices) and local government health workers to advocate to local government executives to self-finance IFA supplies in 30 provinces.



Table 7. Maternal anemia policy and program assessment Guideline, Philippines

Problem Component	Indicator/Information
Policy	The Philippines has a written national IFA supplementation policy (Administrative Order No. 119) and a treatment/prevention protocol, which is part of the Manual of Operation approved by the National Center for Disease Prevention and Control in early 2011.
Political Support	<p>Anemia reduction is mentioned in two national policy/planning documents: National Objectives for Health 2005–2010, and Medium Term Philippine Plan of Action for Nutrition 2005–2010 and targets were set for 2010. Micronutrient supplementation, food fortification (mandatory – iron for rice and flour; and voluntary for processed foods, e.g. noodles and snack foods) are the main strategies used to address anemia.</p> <p>Various inter-agency technical groups formed by the DOH guide and provide technical support to anemia prevention efforts and other micronutrient deficiency strategies.</p>
Program/ Intervention Description	<p>IFA supplementation: In the Philippines, when pregnancy is determined, the rural health midwife provides one tablet of IFA per a day (for a total of 180 days). The IFA is given during the ANC visit at the rural health unit, main health center or village health center outreach activities. Other distribution channels include health campaigns and health events.</p> <p>Dose and form standards for IFA tablets included in the Philippine National Drug Formulary, specify that the tablets must contained 60 mg elemental iron with 400 µg folic acid in a film-coated tablet/capsule. No packaging specifications exist.</p> <p>Malaria prevention and treatment: The Philippines has a national malaria policy. The first line treatment for clinical malaria is an artemisinin combination therapy, Artemether-Lumefantrine. Confirmed diagnosis is necessary; treatment based on clinical signs and symptoms is discouraged. First-line treatment may be provided by village-based health volunteers. The provincial/municipal health office coordinates distribution of long lasting insecticide treated nets.</p>
Logistics	<p>Local government units implement public health based on the 1991 code. Therefore, provincial and municipal health offices procure and distribute micronutrients (except for vitamin A universal supplementation for 6–59 month old children) to all villages. The DOH uses a micronutrient forecasting tool. The formula DOH uses to estimate the IFA supply needed is: total population × 3.5 percent × 180. In 2009, DOH got additional budget and purchased IFA supplements that were given to the centers for health development in the regions.</p> <p>Currently, the only tracking system used by the DOH for IFA is through including the number of pregnant women given IFA tablets during the twice-annual vitamin A supplementation campaign.</p> <p>A2Z assisted the National Center for Disease Prevention and Control to develop a form to track local purchases, donated and externally-provided IFA tablets and their use; but as of early 2011 this form had not yet been implemented.</p>

Table 7. Maternal anemia policy and program assessment Guideline, Philippines (continued)

Training	<p>The integrated maternal and child health training manual and counseling card contain the protocol for supplementing pregnant and post-partum women. Information is also in the Vitamin A Deficiency, Iodine Deficiency Disorders and Iron-deficiency Anemia training manual, and the Community Based Planning and Management of Nutrition Program Rural Health Trainer's Guide. Updates are given during program implementation reviews, seminars, etc.</p> <p>A2Z has provided technical assistance in developing a training manual to accompany the Manual of Operations for Micronutrient Supplementation Programs.</p>
Behavior Change Communication	<p>No formal formative research on IFA adherence exists, but reports on barriers for IFA adherence such as taste, side effects and cost have emerged as part of program implementation reviews and discussion forums. Clients purchase supplements in areas where only 30 capsules are given free of charge as starter supplements.</p> <p>Some communities address the barriers in mothers' classes, bench conferences, or counseling sessions. DOH and partner agencies developed a local language flyer for iron supplementation; some communities have adapted this flyer to local conditions and adopted its use.</p>
Monitoring	<p>IFA is included in the target client list for prenatal care/postpartum care and the maternal and child booklet. ANC attendance is monitored through the Field Health Service Information System to assess whether pregnant women receive the recommended four visits. Based on this data source, national coverage of 4 or more ANC visits is 62 percent, and "complete" receipt of IFA during pregnancy and the postpartum period is 41 percent and 37 percent, respectively.</p>
Demand Creation	<p>Demand creation is integrated into the Child Health Week twice a year, in the pregnant women congress, and other health events. These events promote visits to a health facility for ANC check-ups as soon as the woman knows that she is pregnant, daily consumption of iron tablets for 6 months, and at least four ANC visits during the entire pregnancy (i.e. at least once per trimester except in the third trimester, when at least two visits are recommended). The government has also strengthened public-private partnership on programs to achieve rapid reduction of maternal and neonatal mortality.</p> <p>Community mobilization strategies to promote interventions to reduce maternal anemia include the mass media, social mobilization, and nutrition education activities in health events particularly during the Preschoolers' Health Week and Safe Motherhood campaigns and celebrations. Community-based health workers identify pregnant women in the community and refer them to the health center or barangay health station for ANC consultations. Those trained provide counseling and help in distributing IFA supplements.</p>



## 5.0

# Conclusions and Recommended Actions

## 5.1 SUMMARY

Using data from recent DHS surveys, this report provides cross-country comparisons on (1) the burden of anemia in women—both pregnant and non-pregnant, (2) the reach, timing and frequency of use of antenatal care (ANC) services by pregnant women, (3) the reach and use of key interventions that aim to prevent and/or reduce the anemia burden in women. The report also offers a preliminary assessment framework for examining the status of key program components known to be essential for effective maternal anemia interventions.

- ***The burden of anemia in pregnant women remains serious and unacceptably high.*** Data from the 24 DHS surveys that collected hemoglobin levels in pregnant women confirm what has long been known—anemia in pregnancy remains a serious public health problem and is one of the most widespread disorders in pregnancy. Among the 24 countries examined, the anemia burden in pregnancy exceeded 50 percent in 13 countries, was between 30–49 percent in 10 countries, and was less than 30 percent in only one country (Haiti). Although anemia is not a specific indicator for iron-deficiency, it is assumed that a high proportion of the observed anemia is due to a deficit of iron, especially during pregnancy. The consequences of iron-deficiency anemia in pregnancy are serious—higher risk of the mother’s own mortality, having a low birth weight baby, neonatal mortality and possibly post-neonatal mortality, and placing the mother’s infant at greater risk of iron-deficiency and lower cognitive and motor development.
- ***Reducing the anemia burden in pregnant women, has progressed minimally especially in African countries.*** Among the 11 countries for which consecutive DHS surveys measured anemia in pregnant women, eight countries (Mali, Ghana, Uganda, Senegal, Egypt, Jordan, India, Philippines) showed no measurable change or an increase in anemia prevalence over the five-year period spanning the surveys. Only three countries (Cambodia, Nepal and Haiti) showed measurable declines in anemia prevalence. Comparing and contrasting programmatic and contextual factors between countries that have reduced their anemia burden with countries whose anemia levels have not declined may provide lessons about critical factors necessary for successful maternal anemia reduction strategies.

- **The burden of anemia in non-pregnant women, while somewhat lower than that for pregnant women, puts women at risk of anemia when they become pregnant.** Anemia prevalence in non-pregnant women exceeded 40 percent in 14 of the 24 countries examined. In only one country (Honduras) was the prevalence less than 20 percent. Many reproductive age women in developing countries consume diets of low iron bioavailability and therefore are likely to start their next pregnancy with no iron stores and poor hemoglobin concentrations, putting herself and her infant at risk of the consequences of iron-deficiency anemia.
- **A high-proportion of pregnant women participate in at least one ANC visit, but the correlation between ANC use and iron tablet consumption is weak.** Out 34 countries examine, 22 reported that 80 percent or more women had at least one ANC visit during their last pregnancy, yet only three countries (Benin, Jordan and Honduras) reported that greater than 50 percent of women had consumed 90 or more iron tablets during the last pregnancy. This large discrepancy between ANC use and minimally adequate maternal iron supplementation needs to be more fully examined. ANC serves as a platform for many maternal health interventions, including those such as iron supplementation, IPTp, and de-worming. Yet the low levels of iron supplementation despite high levels of ANC participation suggest issues of poor program implementation.
- **In places where access to and participation in ANC care clinics is adequate, other factors need to be examined,** such as inadequate supply of iron tablets, which can be affected by cost and weak logistic systems; poor quality of counseling by health workers about the need for iron supplementation and its potential benefits and side-effects; lack of knowledge and concern about maternal anemia by both pregnant women and health care providers; and low motivation and some resistance among pregnant women to consume the iron supplement because of undesirable characteristics of the iron tablets or side effects experienced by women.
- **Access and participation in ANC services is not high in all countries.** Less than two-thirds of women from Chad, Ethiopia, Niger, Nigeria, Bangladesh and Pakistan reported having at least one ANC visit. In 12 countries, the first ANC visit occurs mid-way through the second trimester (fifth month of pregnancy), two to three months later than the recommended timing of the first visit.
- **Strong evidence exists of inequitable access and participation in ANC for poorer, less educated and/or rural women in countries such as Bangladesh, Chad, Egypt, Ethiopia, Nepal, Niger, Nigeria, and Pakistan.** Special emphasis is needed to improve reach, access and participation by these more marginalized groups.
- **Improving coverage of intermittent preventive treatment for pregnant women (IPTp) in areas with high malaria endemicity is required.** Of the 15 countries for which data on antimalarial medication use during pregnancy were available, only eight had coverage rates exceeding 50 percent. Countries

such as Malawi, Senegal and Zambia had coverage rates exceeding 80 percent demonstrating that high coverage is possible in challenging settings. Yet, countries such as Ethiopia, Niger, Nigeria, Rwanda, Sierra Leone, Uganda and Zimbabwe have IPTp coverage rates less than 50 percent. It is unclear whether these low rates are due to selective geographic implementation of IPTp in these countries or poor implementation. Further investigation into these issues is needed. In countries such as Uganda, Zambia and Zimbabwe with ANC coverage rates that exceed 90 percent, increasing IPTp coverage could occur rapidly if this intervention is effectively integrated into ANC services. However, in countries such as Ethiopia, Niger, and Nigeria where ANC use is still low, efforts to increase ANC access and participation along with community-outreach efforts should be explored.

- **Increased use of insecticide-treated bednets (ITN) is needed among all household members in malaria-endemic areas.** Less than one-third of all pregnant and non-pregnant women slept under an ITN in all 17 countries for which data were available.
- **Increasing presumptive treatment of hookworms is required in areas where hookworms are known to be endemic.** De-worming coverage among pregnant women is low based on the 13 countries for which data were available. The highest coverage rates were 38.7 percent and 34.8 percent for Zambia and Ghana, respectively, but the majority of other countries had coverage rates lower than 10 percent.

In summary, these cross-country comparisons in anemia prevalence, ANC use and reach of maternal anemia interventions provide a spring-board for more in-depth examination of country and context-specific barriers and enablers of effective implementation strategies. They raise important questions such as: (i) why have anemia levels in pregnant and non-pregnant women remained so high?; (ii) what is different about the implementation strategies and context being used in the few countries where maternal anemia prevalence was reduced (i.e. Nepal and Cambodia) compared with the overwhelming number of countries where the situation has worsened or stagnated?; (iii) how can maternal anemia interventions be better integrated and emphasized within ANC services?; (iv) are we providing the right mix of interventions in contexts where multiple causes of anemia in women exist?; (v) how can programs minimize “missed opportunities” for delivery effective interventions?; (vi) how can programs improve iron status in adolescents and non-pregnant women so that they enter pregnancy with optimal stores and hemoglobin concentrations? (vii) how has a low-to-middle-income country like Honduras been able to achieve both high ANC coverage and high consumption of iron supplementation among pregnant women when few others have?

Country- and context-specific answers to the questions above need to be explored to find ways to improve the effectiveness of anemia prevention and reduction interventions. Clues on where to look for these answers may be found in the implementation barriers identified as part of an A2Z-supported consultation

known as the “Innocenti Process”<sup>37</sup>. This review identified the following barriers: (1) inadequate political support, (2) low priority for iron and folic acid supplementation within maternal health programs, (3) insufficient bundling of interventions to address the multiple causes of anemia, (4) inadequate supplies, low utilization and weak demand, (5) lack of convincing evidence of effective program implementation, and (6) the lack of community-based delivery platforms for maternal iron and folic acid supplementation to complement the ante-natal platform.

## 5.2 ACTIONS NEEDED

---

The actions recommended below are based on a review of evidence and a consultation with a broad set of stakeholders undertaken in 2008 (i.e. the “Innocenti Process”) mentioned above.<sup>37</sup> Each country is encouraged to assess its own strategy and the degree to which each component of the strategy is being adequately supported and implemented before selecting from actions listed below or other actions.

### **Increase political commitment**

- Call for a renewed commitment to anemia control building on the strong links between maternal anemia reduction and maternal and perinatal survival (MDG 4 and 5).
- Improve coordination between global stakeholders, including the private sector, to prioritize key activities.
- Provide adequate funding for scale-up and service delivery throughout the maternal health continuum of care.

### **Integrate with health programs**

- Increase focus and attention on the multiple causes of maternal anemia to result in more harmonized and integrated implementation of prevention and treatment efforts.
- Identify and nurture champions for maternal anemia within maternal and child health and nutrition, reproductive health, malaria, HIV, TB, and neglected tropical diseases communities.
- Integrate standard anemia control strategies, training, messages, and protocols across focused ANC/birth/postpartum, and infectious disease policies, guidelines, and programs.

### **Provide pharmaceuticals and supplies**

- Strengthen and maintain strong supply systems for the package of maternal anemia control activities.
- Ensure adequate, quality supplies of IFA for supplementation, oxytocin for AMTSL or misoprostol for community-based use, and contraceptives for birth spacing.

- Ensure availability of antihelminths where hookworm is present and locally effective antimalarial medications, bednets, and insecticides for spraying in malaria-endemic areas.
- Increase the safety of packaging, ease of use and affordability of commodities, through public-private-community linkages.

### **Expand roles for communities**

- Use communities to increase women's access to the full package of services to prevent common causes of anemia.
- Use complementary service delivery platforms, such as community-based distribution, to reach pregnant women.
- Build community-clinic linkages to bridge the gap between community advocacy/support and clinical service delivery.
- Use community health networks to bring needed services, supplies, and follow-up directly to the homes of pregnant women.
- Listen and take action to overcome the barriers women face in accessing anemia prevention and treatment to develop context-relevant approaches, such as providing the full IFA course at first treatment.

### **Increase demand**

- Use social marketing to create awareness of and demand for services and supplies. Counseling at the community and health service level can help women understand and adhere to IFA supplementation, family planning, and other interventions.
- Use supportive supervision systems to reinforce adequate counseling of pregnant women and ensure that local realities are addressed in the counseling provided.
- Empower health workers and volunteers for quality counseling to improve adherence.

### **Strengthen monitoring and evaluation**

- Facilitate quality service delivery of interventions addressing the root causes of maternal anemia by monitoring program implementation indicators.
- Integrate indicators on quality and coverage of ANC, family planning and reproductive health, malaria prevention, and other health services into routine health information systems.
- Establish supportive supervision systems for both clinical staff and community-based volunteers to put the information to work in addressing gaps in implementation and reinforcing program progress.

# References

1. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. *Public Health Nutr* 2009; Apr; 12(4):444-54.
2. Stoltzfus R, Mullany L, Black R. Iron Deficiency Anemia, Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. WHO; 2004.
3. Sanghvi TG, Harvey PW, Wainwright E. Maternal iron-folic acid supplementation programs: evidence of impact and implementation. *Food Nutr Bull* 2010; Jun; 31(2 Suppl):S100-7.
4. Nanche D, Lahuerta M, Bardaji A, Sigauque B, Romagosa C, Berenguera A, et al. Mother-to-child transmission of HIV-1: association with malaria prevention, anaemia and placental malaria. *HIV Med* 2008; Oct; 9(9):757-64.
5. Mehta S, Manji KP, Young AM, Brown ER, Chasela C, Taha TE, et al. Nutritional indicators of adverse pregnancy outcomes and mother-to-child transmission of HIV among HIV-infected women. *Am J Clin Nutr* 2008; Jun; 87(6):1639-49.
6. Lackritz EM. Prevention of HIV transmission by blood transfusion in the developing world: achievements and continuing challenges. *AIDS* 1998; 12 Suppl A:S81-6.
7. Humphrey JH, Hargrove JW, Malaba LC, Iliff PJ, Moulton LH, Mutasa K, et al. HIV incidence among postpartum women in Zimbabwe: risk factors and the effect of vitamin A supplementation. *AIDS* 2006; Jun 26; 20(10):1437-46.
8. Christian P, Khatry SK, Katz J, Pradhan EK, LeClerq SC, Shrestha SR, et al. Effects of alternative maternal micronutrient supplements on low birth weight in rural Nepal: double blind randomised community trial. *BMJ* 2003; Mar 15; 326(7389):571.
9. Zeng L, Dibley MJ, Cheng Y, Dang S, Chang S, Kong L, et al. Impact of micronutrient supplementation during pregnancy on birth weight, duration of gestation, and perinatal mortality in rural western China: double blind cluster randomised controlled trial. *BMJ* 2008; Nov 7; 337:a2001.
10. Titaly CR, Dibley MJ, Roberts CL, Agho K. Combined iron/folic acid supplements and malaria prophylaxis reduce neonatal mortality in 19 sub-Saharan African countries. *Am J Clin Nutr* 2010; Jul; 92(1):235-43.
11. Titaly CR, Dibley MJ, Roberts CL, Hall J, Agho K. Iron and folic acid supplements and reduced early neonatal deaths in Indonesia. *Bull World Health Organ* 2010; Jul 1; 88(7):500-8.
12. Christian P, Stewart CP, LeClerq SC, Wu L, Katz J, West KP Jr, et al. Antenatal and postnatal iron supplementation and childhood mortality in rural Nepal: a prospective follow-up in a randomized, controlled community trial. *Am J Epidemiol* 2009; Nov 1; 170(9):1127-36.
13. Miller MF, Stoltzfus RJ, Mbuya NV, Malaba LC, Iliff PJ, Humphrey JH, et al. Total body iron in HIV-positive and HIV-negative Zimbabwean newborns strongly predicts anaemia throughout infancy and is predicted by maternal hemoglobin concentration. *J Nutr* 2003; Nov; 133(11):3461-8.
14. Perez EM, Hendricks MK, Beard JL, Murray-Kolb LE, Berg A, Tomlinson M, et al. Mother-infant interactions and infant development are altered by maternal iron deficiency anemia. *J Nutr* 2005; Apr; 135(4):850-5.
15. Christian P, Murray-Kolb LE, Khatry SK, Katz J, Schaefer BA, Cole PM, et al. Prenatal micronutrient supplementation and intellectual and motor function in early school-aged children in Nepal. *JAMA* 2010; Dec 22; 304(24):2716-23.
16. Haas JD, Brownlie T, 4th. Iron deficiency and reduced work capacity: a critical review of the research to determine a causal relationship. *J Nutr* 2001; Feb; 131(2S-2):676S,688S; discussion 688S-690S.
17. Carter RC, Jacobson JL, Burden MJ, Armony-Sivan R, Dodge NC, Angelilli ML, et al. Iron deficiency anemia and cognitive function in infancy. *Pediatrics* 2010; Aug; 126(2):e427-34.
18. Falkingham M, Abdelhamid A, Curtis P, Fairweather-Tait S, Dye L, Hooper L. The effects of oral iron supplementation on cognition in older children and adults: a systematic review and meta-analysis. *Nutr J* 2010; Jan 25; 9:4.
19. Glazer Y, Bilenko N. Effect of iron deficiency and iron deficiency anemia in the first two years of life on cognitive and mental development during childhood. *Harefuah* 2010; May; 149(5):309,14, 335.
20. Madan N, Rusia U, Sikka M, Sharma S, Shankar N. Developmental and neurophysiologic deficits in iron deficiency in children. *Indian J Pediatr* 2011; Jan; 78(1):58-64.
21. Horton S., Ross J. The economics of iron deficiency. *Food Policy* 2003; 28:51-75.

22. Stoltzfus RJ. Iron Interventions for Women and Children in Low-Income Countries. *J Nutr* 2011; Mar 2;.
23. DeMaeyer E, Adiels-Tegman M. The prevalence of anaemia in the world. *World Health Stat Q* 1985;38(3):302-16.
24. Pena-Rosas JP, Viteri FE. Effects and safety of preventive oral iron or iron+folic acid supplementation for women during pregnancy. *Cochrane Database Syst Rev* 2009; Oct 7;(4)(4):CD004736.
25. WHO. Iron deficiency anaemia assessment, prevention and control. A guide for programme managers. Geneva, Switzerland: World Health Organization; 2001.
26. WHO. Weekly iron-folic acid supplementation (WIFS) in women of reproductive age: its role in promoting optimal maternal and child health. Position statement. Geneva, Switzerland: World Health Organization; 2009.
27. WHO. Report of the WHO Informal Consultation on hookworm infection and anemia in girls and women 1994; WHO/CTD/SIP/96.1.
28. Lengeler C. Insecticide-treated bednets and curtains for preventing malaria. *Cochrane Database Syst Rev* 2004;(2)(2):CD000363.
29. White NJ. Assessment of the pharmacodynamic properties of antimalarial drugs in vivo. *Antimicrob Agents Chemother* 1997; Jul;41(7):1413-22.
30. WHO. Making Pregnancy Safer: Standards for Maternal and Newborn Care. Geneva, Switzerland: World Health Organization; 2006.
31. Beard JL. Effectiveness and strategies of iron supplementation during pregnancy. *Am J Clin Nutr* 2000; May;71(5 Suppl):1288S-94S.
32. Aziken ME, Akubuo KK, Gharoro EP. Efficacy of intermittent preventive treatment with sulfadoxine-pyrimethamine on placental parasitemia in pregnant women in midwestern Nigeria. *Int J Gynaecol Obstet* 2011; Jan;112(1):30-3.
33. Falade CO, Yusuf BO, Fadero FF, Mokuolu OA, Hamer DH, Salako LA. Intermittent preventive treatment with sulphadoxine-pyrimethamine is effective in preventing maternal and placental malaria in Ibadan, south-western Nigeria. *Malar J* 2007; Jul 6;6:88.
34. Verhoeff FH, Brabin BJ, Chimsuku L, Kazembe P, Russell WB, Broadhead RL. An evaluation of the effects of intermittent sulfadoxine-pyrimethamine treatment in pregnancy on parasite clearance and risk of low birthweight in rural Malawi. *Ann Trop Med Parasitol* 1998; Mar;92(2):141-50.
35. Uganda Bureau of Statistics (UBOS) and Macro International Inc. Uganda Demographic and Health Survey 2006. Calverton, Maryland, USA: UBOS and Macro International Inc.; 2007.
36. Mwadime RKN, Harvey PWJ, Naikoba S, Sserujongi L, Bachow H, Arinaitwe L, Maina WG. Overcoming Barriers to Effective Maternal Anemia Interventions during Antenatal Services in Uganda. Washington, DC.: MOST/RCQHC; 2002.
37. Klemm RDW, Harvey PWJ, Wainwright E, Faillace S. Micronutrient Programs: What Works and What Needs More Work? A Report of the 2008 Innocenti Process. Washington, DC.: Micronutrient Forum; 2009.



# Appendices

- Appendix 1 Anemia prevalence and mean hemoglobin (SD) among pregnant women
- Appendix 2 Anemia prevalence and mean hemoglobin (SD) among non-pregnant women
- Appendix 3 Changes in anemia prevalence among pregnant women over two consecutive DHS surveys
- Appendix 4 Changes in anemia prevalence among non-pregnant women over two consecutive DHS surveys in selected countries
- Appendix 5 Antenatal care (ANC) participation, frequency and timing
- Appendix 6 Relative odds of ANC participation by residence, maternal education and household wealth
- Appendix 7 Maternal iron supplementation—iron table receipt and consumption
- Appendix 8 Changes in maternal iron supplementation over two consecutive DHS surveys
- Appendix 9 Use of anti-malarial medicine during pregnancy
- Appendix 10 Use of bednets among pregnant and non-pregnant women
- Appendix 11 Use of de-worming medication during pregnancy
- Appendix 12 Public health significance of anemia, malaria and hookworm by country

Appendix I. Anemia prevalence and mean hemoglobin (SD) among pregnant women

		Year	Pregnant Women <sup>1</sup>		Prevalence of Anemia (%) <sup>2</sup>				
			Number of Women Surveyed	Hb Concentration (g/L)		Mild	Mod.	Severe	Any
				Mean	Sd				
<b>Africa</b>	Benin	2006	NA <sup>3</sup>	NA	NA	NA	NA	NA	NA
	Cameroon	2004	535	109.1	16.7	18.8	31.4	0.7	50.9
	Chad <sup>3</sup>	2004	NA	NA	NA	NA	NA	NA	NA
	Congo (Brazzaville)	2007	524	106.2	17.9	24.6	32.7	2.7	60.0
	Ethiopia	2005	520	117.7	21.6	14.7	13.0	3.0	30.6
	Ghana	2008	351	100.6	17.9	23.4	40.0	6.6	70.0
	Guinea	2005	387	103.1	17.7	27.3	38.2	4.0	69.4
	Lesotho	2004	201	116.0	17.6	16.5	19.5	0.0	36.0
	Liberia <sup>3</sup>	2007	NA	NA	NA	NA	NA	NA	NA
	Madagascar	2003-04	229	109.8	18.3	20.9	27.7	1.5	50.1
	Malawi	2004	352	109.6	16.8	22.5	22.9	1.9	47.3
	Mali	2006	580	101.9	17.0	26.9	44.2	5.9	76.9
	Namibia	2006	NA	NA	NA	NA	NA	NA	NA
	Niger	2006	627	107.4	19.0	30.8	28.0	2.7	61.5
	Nigeria	2008	NA	NA	NA	NA	NA	NA	NA
	Rwanda	2005	432	114.5	22.9	13.1	16.9	5.0	35.0
	Senegal	2008	425	100.6	17.2	25.7	37.9	5.8	69.4
	Swaziland	2006-07	252	114.8	16.0	23.5	16.3	0.4	40.2
	Tanzania	2004-05	1,075	105.6	17.8	22.7	32.8	2.7	58.2
	Uganda	2006	349	107.6	16.9	31.2	30.6	2.6	64.4
Zambia	2007	NA	NA	NA	NA	NA	NA	NA	
Zimbabwe	2005-06	525	114.0	15.1	27.4	18.1	1.5	47.0	
<b>North Africa and Middle East</b>	Egypt	2005	596	114.0	13.4	19.7	14.2	0.3	34.2
	Jordan	2007	615	115.3	13.8	21.8	14.7	0.1	36.6
<b>Asia</b>	Cambodia	2005	486	105.5	16.6	23.4	30.3	3.4	57.1
	India	2005-06	6,028	106.6	32.3	25.8	30.6	2.2	58.7
	Indonesia	2007	NA	NA	NA	NA	NA	NA	NA
	Nepal	2006	604	112.1	15.5	22.7	19.1	0.7	42.4
	Pakistan	2006-07	NA	NA	NA	NA	NA	NA	NA
	Philippines <sup>4</sup>	2008	NA	NA	NA	26.6	15.6	0.4	42.6
<b>LAC</b>	Haiti	2005-06	290	108.9	19.5	19.6	27.4	3.3	50.4
	Honduras	2005-06	1,042	119.6	13.4	15.4	5.8	0.2	21.4

1. Among pregnant women between 15 and 49 years of age at time of survey
2. Mild, Moderate, Severe and any anemia in pregnant women defined as hemoglobin concentration <7g/dl, 7-10g/dl, 10-11g/dl and <11g/dl respectively
3. Hb data not available
4. Philippines 7th National Nutrition Survey, FNRI, 2008

## Appendix 2. Anemia prevalence and mean hemoglobin (SD) among non-pregnant women

		Non-Pregnant Nor Breastfeeding Women <sup>1</sup>							
		Year	Number of Women Surveyed	Hb Concentration (g/L)		Prevalence of Anemia (%) <sup>2</sup>			
				Mean	Sd	Mild	Mod.	Severe	Any
<b>Africa</b>	Benin	2006	NA <sup>3</sup>	NA	NA	NA	NA	NA	NA
	Cameroon	2004	NA	120.8	17.6	34.1	9.3	0.8	44.3
	Chad	2004	NA	NA	NA	NA	NA	NA	NA
	Congo (Brazzaville)	2007	4,166	118.2	24.4	36.8	14.3	0.9	52.0
	Ethiopia	2005	5,620	128.5	19.6	17.7	7.4	1.1	26.2
	Ghana	2008	4,396	114.2	17.6	40.0	16.1	1.6	57.8
	Guinea	2005	3,501	118.3	31.7	36.2	12.6	2.8	51.6
	Lesotho	2004	2,807	126.0	22.7	22.8	8.9	1.1	32.7
	Liberia	2007	NA	NA	NA	NA	NA	NA	NA
	Madagascar	2003-04	2,383	116.9	33.5	35.9	6.6	3.0	45.6
	Malawi	2004	2,268	120.6	18.9	33.4	8.7	1.7	43.9
	Mali	2006	4,162	114.2	17.2	46.2	19.0	2.2	67.4
	Namibia	2006	NA	NA	NA	NA	NA	NA	NA
	Niger	2006	3,681	121.0	18.9	31.9	9.9	1.3	43.0
	Nigeria	2008	NA	NA	NA	NA	NA	NA	NA
	Rwanda	2005	5,225	125.8	23.3	19.7	8.4	4.6	32.6
	Senegal	2008	5,609	112.5	17.5	44.8	16.1	2.4	63.3
	Swaziland	2006-07	4,346	126.7	16.9	22.4		0.3	29.9
	Tanzania	2004-05	9,065	119.6	17.8	33.8	12.4	1.0	47.2
	Uganda	2006	2,485	122.6	16.7	35.4	10.9	0.5	46.9
Zambia	2007	NA	NA	NA	NA	NA	NA	NA	
Zimbabwe	2005-06	7,109	128.9	72.9	27.3	8.8	1.0	37.1	
<b>North Africa and Middle East</b>	Egypt	2005	5,693	121.6	13.4	34.0	5.6	0.3	39.9
	Jordan	2007	4,298	122.3	14.3	30.6	7.2	0.2	37.8
<b>Asia</b>	Cambodia	2005	7,733	119.5	16.3	36.1	9.0	0.9	46.0
	India	2005-06	110,827	116.5	30.9	39.3	14.1	1.7	55.2
	Indonesia	2007	NA	NA	NA	NA	NA	NA	NA
	Nepal	2006	10,042	124.3	15.7	29.8	5.6	0.4	35.8
	Pakistan	2006-07	NA	NA	NA	NA	NA	NA	NA
	Philippines <sup>4</sup>	2008	NA	NA	NA	19.5	3.0	0.2	22.7
<b>LAC</b>	Haiti	2005-06	NA	119.0	19.1	31.6	11.9	2.0	45.4
	Honduras	2005-06	NA	130.9	15.4	16.0	2.1	0.4	18.5

1. Weighted average among non-pregnant breast feeding and non-pregnant/non-breastfeeding women 15-49 years of age at time of the survey
2. Mild, Moderate, Severe and any anemia in pregnant women defined as hemoglobin concentration <7g/dl, 7-10g/dl, 10-11g/dl and <11g/dl respectively
3. Hb data not available
4. Philippines 7th National Nutrition Survey, FNRI, 2008

### Appendix 3. Changes in anemia prevalence among pregnant women over two consecutive DHS surveys

		<b>Anemia Prevalence in Pregnant Women<sup>1,2</sup></b>					
		Year	Number of Women Surveyed	Mild %	Moderate %	Severe %	Any %
<b>Africa</b>	Mali	2001	524	24.5	43.6	5.2	73.4
	Mali	2006	580	26.9	44.2	5.9	76.9
	Ghana	2003	400	33.2	26.7	1.2	61.1
	Ghana	2008	351	23.4	40.0	6.6	70.0
	Uganda	2000-01	860	22.1	17.1	2.0	41.2
	Uganda	2006	349	31.2	30.6	2.6	64.4
	Senegal	2005	352	25.7	39.8	5.1	70.6
	Senegal	2008	425	25.7	37.9	5.8	69.4
<b>North Africa and Middle East</b>	Egypt	2000	627	13.3	9.7	0.6	23.6
	Egypt	2005	596	19.7	14.2	0.3	34.2
	Jordan	2002	227	23.4	13.5	0.1	37
	Jordan	2007	615	21.8	14.7	0.1	36.6
<b>Asia</b>	Cambodia	2000	232	27.2	33.8	4.1	65.1
	Cambodia	2005	486	23.4	30.3	3.4	57.1
	India	1998-99	5,725	21.8	25.4	2.5	49.7
	India	2005-06	6,028	25.8	30.6	2.2	58.6
	Nepal <sup>3</sup>	1998	3,437	NA	68.9 <sup>4</sup>	5.7	74.6
	Nepal	2006	604	22.7	19.1	0.7	42.5
	Philippines <sup>5</sup>	1998	NA	27.2	22.4	0.8	50.4
	Philippines <sup>6</sup>	2003	NA	25.1	18.5	0.3	43.9
Philippines <sup>7</sup>	2008	NA	26.6	15.6	0.4	42.6	
<b>LAC</b>	Haiti	2000	388	30.1	29.7	3.6	63.4
	Haiti	2005-06	290	19.6	27.4	3.3	50.3

1. Among pregnant women between 15 and 49 years of age at time of survey
2. Mild, moderate, severe and any anemia in pregnant women defined as hemoglobin concentration <7g/dL, 7-10g/dL, 10-11g/dL and >11g/dL respectively
3. Data from Nepal Micronutrient Status Survey, 1998
4. Moderate anemia defined as hemoglobin concentration 7-11 g/dL
5. Data from Philippines National Nutrition Survey (NNS), FNRI-DOST 1998
6. Data from Philippines National Nutrition Survey (NNS), FNRI-DOST 2003
7. Data from Philippines National Nutrition Survey (NNS), FNRI-DOST 2008

Appendix 4. Changes in anemia prevalence among non-pregnant women over two consecutive DHS surveys in selected countries

		<b>Anemia Prevalence in Non-pregnant Women<sup>1,2</sup></b>				
		Number of Women Surveyed	Mild %	Moderate %	Severe %	Any %
<b>Africa</b>	Mali	41.2	16.2	2.3	59.7	59.7
	Mali	45.8	18.4	2.2	66.5	66.5
	Ghana	33.1	7.6	0.9	41.6	41.6
	Ghana	38.8	16.1	1.6	56.6	56.6
	Uganda	19.7	5.9	0.6	26.3	26.3
	Uganda	32.9	9.6	0.5	43.1	43.1
	Senegal	37.0	17.4	3.2	57.5	57.5
	Senegal	44.8	16.1	2.4	63.3	63.3
<b>North Africa and Middle East</b>	Egypt	23.6	4.2	0.3	28.0	28.0
	Egypt	34.0	5.6	0.3	39.9	39.9
	Jordan	22.2	5.7	0.2	28.0	28.0
	Jordan	30.6	7.2	0.2	37.9	37.9
<b>Asia</b>	Cambodia	46.0	11.3	1.1	58.4	58.4
	Cambodia	36.1	9.0	0.9	46.0	46.0
	India	36.1	14.0	1.8	51.9	51.9
	India	39.3	14.1	1.7	55.1	55.1
	Nepal <sup>3</sup>	NA	65.0 <sup>4</sup>	1.7	66.7	66.7
	Nepal	29.8	5.6	0.4	35.8	35.8
	Philippines <sup>5</sup>	28.6	4.8	0.2	33.6	33.6
	Philippines <sup>6</sup>	NA	NA	NA	NA	22.7
Philippines <sup>7</sup>	NA	19.5	3.0	0.2	22.7	
<b>LAC</b>	Haiti	36.9	14.6	3.0	54.5	54.5
	Haiti	31.6	11.9	2.0	45.5	45.5

1. Weighted average among non-pregnant breast feeding and non-pregnant/non-breastfeeding women 15-49 years of age at time of the survey
2. Mild, moderate, severe and any anemia in non-pregnant women defined as hemoglobin concentration <7g/dL, 7-10g/dL, 10-12g/dL and <12g/dL respectivelyData from Nepal Micronutrient Status Survey, 1998
3. Data from Nepal Micronutrient Status Survey, 1998
4. Moderate anemia defined as hemoglobin concentration 7-12g/dL
5. Data from Philippines National Nutrition Survey (NNS), FNRI-DOST 1998
6. Data from Philippines National Nutrition Survey (NNS), FNRI-DOST 2003
7. Data from Philippines National Nutrition Survey (NNS), FNRI-DOST 2008

## Appendix 5. Antenatal care (ANC) participation, frequency, and timing

		Year	Number of Women Surveyed <sup>1</sup>	At least One ANC Visit (%) <sup>2</sup>	Median Number of Visits (IQR) <sup>3</sup>	Median Month of First Visit (IQR)
<b>Africa</b>	Benin	2006	6,896	87.5	5 (3, 6)	4 (3, 5)
	Cameroon	2004	4,230	82.4	5 (3, 6)	4 (3, 5)
	Chad	2004	3,079	43.7	3 (3, 5)	4 (3, 5)
	Congo (Brazzaville)	2005	2,776	86.9	5 (4, 6)	3 (3, 4)
	DR Congo	2007	4,581	83.5	4 (3, 5)	5 (4, 6)
	Ethiopia	2005	5,786	27.4	3 (2, 5)	5 (4, 7)
	Ghana	2008	1,560	94.4	6 (4, 8)	3 (3, 5)
	Guinea	2005	3,552	78.5	4 (3, 6)	4 (3, 5)
	Lesotho	2004	2,085	87.9	5 (4, 7)	4 (3, 6)
	Liberia	2007	2,955	85.3	6 (4, 7)	3 (2, 4)
	Madagascar	2003-04	3,283	80.1	3 (3, 4)	5 (4, 6)
	Malawi	2004	5,947	94.7	4 (3, 5)	5 (4, 6)
	Mali	2006	7,564	69.8	4 (3, 5)	4 (3, 5)
	Namibia	2006-07	2,847	87.0	5 (4, 7)	4 (3, 6)
	Niger	2006	5,302	47.5	3 (2, 4)	4 (3, 6)
	Nigeria	2008	14,530	54.1	6(4, 10)	5 (3, 6)
	Rwanda	2005	4,575	94.5	3 (2, 3)	6 (5, 7)
	Senegal	2005	5,670	91.1	3 (3, 4)	3 (3, 4)
	Swaziland	2006-07	1,572	94.8	5 (4, 6)	5 (4, 6)
	Tanzania	2004-05	4,656	96.5	4 (3, 5)	5 (4, 6)
Uganda	2006	4,204	94.7	3 (3, 5)	5 (4, 6)	
Zambia	2007	3,454	96.5	4 (3, 5)	5 (4, 6)	
Zimbabwe	2005-06	2,983	93.5	5 (3, 6)	5 (3, 6)	
<b>North Africa</b>	Egypt	2005	7,256	72.4	7(5, 10)	2 (2, 3)
	Jordan	2007	4,857	98.8	8 (6, 9)	2 (1, 3)
<b>Asia</b>	Bangladesh	2007	3,352	62.6	3 (1, 5)	5 (3, 6)
	Cambodia	2005	4,252	72.9	3 (2, 4)	5 (3, 6)
	India	2005-06	28,862	76.3	3 (2, 6)	3 (2, 5)
	Indonesia	2007	9,283	95.2	8 (5, 9)	2 (1, 3)
	Nepal	2006	2,899	75.7	3 (2, 4)	4 (3, 5)
	Pakistan	2006-07	4,434	65.3	3 (2, 6)	4 (2, 6)
	Philippines	2008	3,325	95.8	6 (4, 8)	3 (2, 5)
<b>LAC</b>	Haiti	2006-07	3,126	86.0	4 (3, 6)	3 (2, 5)
	Honduras	2005-06	5,430	92.1	6 (5, 7)	2 (2, 4)

1. Among women who had a live birth within 3 years of the survey
2. Excludes missing and don't know responses
3. IQR= Inter-quartile range (ie- 25th and 75th percentile)

Appendix 6. Relative odds of ANC participation by residence, maternal education, and household wealth

		Year	One or more ANC visit (%)		Odds Ratio-Rural vs. Urban Residence	One or more ANC visit (%)		Odds Ratio-No Schooling vs. Secondary or Higher	One or more ANC visit (%)		Odds Ratio-Lowest vs. Highest Wealth Quintile
			Rural Residence	Urban Residence		No Schooling	Secondary or Higher		Lowest Wealth Quintile	Highest Wealth Quintile	
<b>Africa</b>	Benin	2006	85.3	92.3	0.92	84.0	99.6	0.84			
	Cameroon	2004	74.3	93.9	0.79	57.9	98.0	0.59	65.2	97.4	0.67
	Chad	2004	35.2	80.7	0.44	33.6	93.5	0.36	9.6	76.8	0.13
	Congo (Brazzaville)	2005	79.6	94.1	0.85	67.0	92.6	0.72	75.4	97.7	0.77
	DR Congo	2007	81.2	91.7	0.89	74.4	93.9	0.79	78.3	95.4	0.82
	Ethiopia	2005	23.9	68.0	0.35	21.7	79.7	0.27	12.7	56.5	0.22
	Ghana	2008	93.8	97.9	0.96	93.7	97.6	0.96	92.5	99.5	0.93
	Guinea	2005	78.0	95.8	0.81	79.8	98.5	0.81	68	98	0.69
	Lesotho	2004	89.3	95.9	0.93	72.8	93.8	0.78	87.6	96.1	0.91
	Liberia	2007	72.9	95.0	0.77	75.8	93.3	0.81	68.2	96.3	0.71
	Madagascar	2003-04	77.1	89.9	0.86	59.1	97.0	0.61	66.5	96.6	0.69
	Malawi	2004	92.4	98.4	0.94	88.1	97.9	0.90	89.6	97.6	0.92
	Mali	2006	65.2	86.8	0.75	67.9	95.2	0.71	62.4	92.1	0.68
	Namibia	2006-07	93.0	96.3	0.97	77.0	97.3	0.79	89.7	97	0.92
	Niger	2006	39.2	87.3	0.45	42.3	93.6	0.45	36.9	81.7	0.45
	Nigeria	2008	46.0	83.3	0.55	30.9	87.5	0.35	23.8	93.8	0.25
	Rwanda	2005	94.7	92.7	1.02	91.7	97.6	0.94	91.4	95.6	0.96
	Senegal	2008-09	91.5	97.7	0.94	92.2	98.7	0.93	85.9	98.5	0.87
	Swaziland	2006-07	96.5	98.0	0.98	97.2	98.0	0.99	95.6	98.7	0.97
	Tanzania	2004-05	93.2	96.4	0.97	90.4	99.6	0.91	90.4	96.1	0.94
Uganda	2006	93.8	97.3	0.96	90.6	96.6	0.94				
Zambia	2007	90.8	98.7	0.92	87.4	97.0	0.90	89.5	98.3	0.91	
Zimbabwe	2005-06	92.8	96.5	0.96	93.4	95.8	0.97	92.1	97.9	0.94	
<b>North Africa and Middle East</b>	Egypt	2005	66.2	84.0	0.79	52.6	84.2	0.62	50.3	93	0.54
	Jordan	2007	98.1	99.1	0.99	92.1	99.2	0.93	97.3	99.9	0.97
<b>Asia</b>	Bangladesh	2007	48.2	72.1	0.67	31.1	71.4	0.44	31.6	85.2	0.37
	Cambodia	2005	69.3	78.7	0.88	52.6	91.1	0.58	57.6	91	0.63
	India	2005-06	70.9	89.8	0.79	60.3	92.9	0.65	57.6	96.7	0.60
	Indonesia	2007	90.6	97.8	0.93	68.4	97.8	0.70	83	99	0.84
	Nepal	2006	69.2	86.9	0.80	59.8	92.9	0.64	49.6	92.2	0.54
	Pakistan	2006-07	54.9	78.9	0.70	51.1	88.7	0.58	37.5	92	0.41
	Philippines	2008	95.7	96.7	0.99	78.7	98.1	0.80	91	99.4	0.92
<b>LAC</b>	Haiti	2005-06	81.6	90.8	0.90	73.3	96.1	0.76	72.3	96.8	0.75
	Honduras	2005-06	90.8	93.7	0.97	80.1	97.1	0.82	87.7	98.7	0.89

## Appendix 7. Maternal iron supplementation—iron tablet receipt and consumption

		Year	Number Surveyed <sup>1</sup>	% of women who were given or bought any iron tablets or syrup in last pregnancy	Number of days iron tablets consumed (%)				Median number of days women took iron tablets/syrup during pregnancy (IQR) <sup>2</sup>
					1 to 59	60-89	90 or more	One or more	
<b>Africa</b>	Benin	2006	10,521	86.2	16.8	10.6	52.9	80.3	90 (45, 150)
	Cameroon	2004	5,303	73.4	15.4	8.0	46.5	69.9	112 (45, 165)
	Chad	2004	3,720	28.8	21.4	0.8	1.4	23.6	15 (4, 30)
	Congo (Brazzaville)	2005	3,568	52.8	25.5	4.0	17.0	46.5	30 (7, 112)
	DR Congo	2007	5,473	46.3	37.9	1.4	1.7	41.0	7 (3, 20)
	Ethiopia	2005	7,307	10.4	9.3	0.1	0.1	9.5	7 (4, 15)
	Ghana	2008	2,099	86.6	28.2	10.1	41.5	79.8	80 (21, 150)
	Guinea	2005	4,447	75.1	21.3	12.4	32.6	66.3	60 (30, 100)
	Lesotho	2004	2,859	38.0	27.7	0.9	3.0	31.6	14 (3, 30)
	Liberia	2007	3,928	87.0	42.7	13.7	13.6	70.0	30 (7, 65)
	Madagascar	2003-04	4,162	32.4	22.7	5.0	2.5	30.2	30 (12, 45)
	Malawi	2004	7,271	79.4	47.6	11.1	17.6	76.3	30 (14, 60)
	Mali	2006	9,087	60.8	26.5	8.5	18.2	53.2	40 (15, 90)
	Namibia	2006-07	3,898	80.1	26.3	6.2	31.0	63.5	35 (7, 120)
	Niger	2006	6,300	45.5	21.1	8.6	14.0	43.7	60 (30, 90)
	Nigeria	2008	17,635	54.6	23.2	3.3	14.5	41	18 (2, 90)
	Rwanda	2005	5,425	28.2	24.0	0.6	0.5	25.1	7 (3, 30)
	Senegal	2005	6,927	90.7	24.1	13.2	39.7	77	60 (25, 125)
	Swaziland	2006-07	2,134	88.4	30.6	6.1	33.5	70.2	30 (14, 120)
	Tanzania	2004-05	5,772	61.2	43.4	6.1	9.8	59.3	30 (7, 60)
Uganda	2006	5,035	63.1	56.4	0.9	0.7	58	6 (3 to 11)	
Zambia	2007	4,136	90.5	26.7	14.0	43.6	84.3	60 (30, 120)	
Zimbabwe	2005-06	4,099	43.0	31.7	2.0	4.7	38.4	14 (5, 30)	
<b>North Africa</b>	Egypt	2005	9,845	53.1	28.6	6.5	14.1	49.2	30 (10, 90)
	Jordan	2007	6,446	80.3	15.4	12.5	50.8	78.7	90 (60, 180)
<b>Asia</b>	Cambodia	2005	5,865	62.8	30.8	9.0	17.6	57.4	30 (15, 90)
	India	2005-06	39,677	65.1	30.6	9.1	23.1	62.8	50 (15, 90)
	Indonesia	2007	14,043	77.6	33.9	8.2	29.2	71.3	50 (14, 120)
	Nepal	2006	4,066	59.3	22.1	8.3	28.8	59.2	66 (30, 120)
	Pakistan	2006-07	5,677	43.5	19.0	6.0	16.3	41.3	60 (20, 120)
	Philippines	2008	4,802	77.1	40.0	7.3	34.0	81.3	31 (15, 120)
<b>LAC</b>	Haiti	2006-07	4,074	64.7	26.1	8.8	26.8	61.7	60 (22, 120)
	Honduras	2005-06	7,774	80.6	4.7	5.2	70.3	80.2	180 (120, 210)

1. Among pregnant women between 15 and 49 years of age at time of survey
2. IQR= Inter-quartile range (ie- 25th and 75th percentile)

## Appendix 8. Changes in maternal iron supplementation over two consecutive dhs surveys

		Year	Number of Women Surveyed	Number of days iron tablets or syrup taken during pregnancy (%)			
				1 to 59 days	60-89 days	90+ days	One or more
<b>Africa</b>	Ghana	2008	2,099	28.2	10.1	41.5	79.8
	Ghana	2003	2,645	20.7	9	39.7	69.4
	Mali	2006	9,087	26.5	8.5	18.2	53.2
	Mali	2001	8,295	17.5	2.9	3	23.4
	Rwanda	2005	5,425	24	0.6	0.5	25.1
	Rwanda	2000	5,141	16.4	0.6	0.3	17.3
	Uganda	2006	5,035	56.4	0.9	0.7	58
	Uganda	2000-01	4,489	44.9	1.1	1.7	47.7
<b>North Africa and Middle East</b>	Egypt	2005	9,845	28.6	6.5	14.1	49.2
	Egypt	2000	7,953	11.7	3	8.3	23
	Jordan	2007	6,446	15.4	12.5	50.8	78.7
	Jordan	2002	3,743	15.9	9.1	46.4	71.4
<b>Asia</b>	Cambodia	2005	5,865	30.8	9	17.6	57.4
	Cambodia	2000	5,714	16.8	1.5	1.2	19.5
	Philippines	2008	4,802	40	7.3	34	4590
	Philippines	2003		38.7	6.3	29.1	4802
<b>LAC</b>	Haiti	2005-06	4,074	26.1	8.8	26.8	61.7
	Haiti	2000	4,254	31.7	4.3	10.8	46.8

## Appendix 9. Use of anti-malarial medicine during pregnancy

		Year	Number of Women Surveyed	% Women Who Reported Taking an Anti-malarial Medicine During Index Pregnancy
<b>Africa</b>	Angola	2006-07	1,015	59.5
	Cameroon	2004	3,173	59
	Congo-Brazz	2005	2,017	63.6
	Ethiopia	2005	4,321	4.9
	Guinea	2005	2,614	70.1
	Malawi	2004	4,604	81.9
	Niger	2006	3,918	48.2
	Nigeria	2008	11,027	18.4
	Rwanda	2005	3,436	5.6
	Senegal	2005	4,391	82.7
	Sierra Leone	2008	2,478	34.1
	Tanzania	2004-05	3,500	57.7
	Uganda	2006	3,247	46.4
	Zambia	2007	2,631	87.2
Zimbabwe	2005-06	2,144	38.5	
<b>LAC</b>	Haiti	2005-06	2,319	3.8

## Appendix 10. Use of bednets among pregnant and non-pregnant women

	Year	All Women <sup>1</sup>			Pregnant women <sup>1</sup>			
		Slept under any net last night (%)	Slept under an ever treated net last night (%)	Slept under an insecticide treated net last night (%)	Slept under any net last night (%)	Slept under an ever treated net last night (%)	Slept under an insecticide treated net last night (%)	
<b>Africa</b>	Angola	2006-07	16.7	14.5	14.1	24.6	22.8	22
	Cameroon	2004	11.6	1.2	1.0	12.4	1.6	1.5
	Congo (Brazzaville)	2005	67.0	7.0	6.1	63.8	4.9	4.2
	Ethiopia	2005	2.3	1.8	1.4	1.6	1.2	1.1
	Guinea	2005	12.8	1.1	1.4	12.7	1.2	1.4
	Liberia	2009	30.0	29.0	29.0	33.8	32.9	32.9
	Malawi	2004	20.6	18.1	14.9	19.3	17.6	14.7
	Niger	2008	9.2	8.9	3.9	11.8	11.5	4.8
	Rwanda	2005	12.8	12.7	10.5	20	20	17.2
	Senegal	2008-09	29.4	26.9	25.3	34.9	31.5	29.7
	Sierra Leone	2008	28.8	28.0	26.5	28.6	27.4	27.2
	Tanzania	2004-05	34.3	22.0	18.2	32.1	19.7	15.8
	Uganda	2006	23.2	13.8	10.1	24.4	13.1	10
	Zambia	2007	33.9	33.0	28.2	38.5	37.4	32.7
Zimbabwe	2005-06	7.9	3.6	3.0	6.8	3.3	3.2	
<b>Asia</b>	Cambodia	2005	85.1	6.9	3.0	85.9	8.5	4.1

1. Among women 15–49 years of age and all pregnant women 15-49 years of age at time of survey

## Appendix 11. Use of de-worming medication during pregnancy

	Year	Number of Women Surveyed <sup>1</sup>	% of women taking a drug for intestinal worms in last pregnancy	
<b>Africa</b>	Ghana	2008	1,556	34.8
	Liberia	2007	2,929	28
	Namibia	2006-07	3,827	7.5
	Nigeria	2008	14,452	9.5
	Swaziland	2006-07	1,570	10.7
	Uganda	2006	4,204	27.4
	Zambia	2007	3,450	37.8
<b>Asia</b>	Cambodia	2005	4,252	11.2
	India	2005-06	28,850	3.7
	Nepal	2006	2,898	24
	Philippines	2008	3,325	3.6
<b>LAC</b>	Haiti	2006-07	3,124	6.9
	Honduras	2005-06	5,429	6.7

1. Among women who had a live birth within 3 years of the survey

Appendix 12a. Public health significance of anemia, malaria, and hookworm by country

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria	
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>	
Africa	Eastern Africa	Burundi	47.1	Severe	Mild	High
		Comoros	55.0	Severe	no data	Elimination
		Djibouti	56.2	Severe	Mild	Low
		Eritrea	55.3	Severe	no data	Low
		Ethiopia	62.7	Severe	Mild	High
		Kenya	55.1	Severe	Mild	High
		Madagascar	50.1	Severe	Mild	Low
		Malawi	47.3	Severe	Moderate	High
		Mauritius	37.5	Moderate	no data	Elimination
		Mayotte	no data		no data	Elimination
		Mozambique	52.4	Severe	no data	High
		Réunion	no data		no data	None
		Rwanda	10.6	Mild	Moderate	High
		Seychelles	24.9	Moderate	no data	None
		Somalia	no data		Mild	High
		Uganda	41.2	Severe	Moderate	High
		United Republic of Tanzania	58.2	Severe	Mild	High
	Zambia	46.9	Severe	Moderate	High	
	Zimbabwe	18.8	Moderate	Severe	Low	
	Middle Africa	Angola	57.1	Severe	Extreme	High
		Cameroon	50.9	Severe	Mild	High
		Central African Republic	54.8	Severe	Moderate	High
		Chad	60.4	Severe	Moderate	High
		Congo	55.3	Severe	Mild	High
		Dem. Republic of the Congo	67.3	Severe	Severe	High
		Equatorial Guinea	41.7	Severe	Mild	Low
		Gabon	46.2	Severe	Mild	Low
		Sao Tome and Principe	40.4	Severe	no data	Elimination
		Northern Africa	Algeria	42.8	Moderate	Minimal
	Egypt		45.4	Severe	Minimal	Elimination
	Libyan Arab Jamahiriya		34.5	Moderate	no data	None
	Morocco		37.2	Moderate	Minimal	Low
	Sudan		57.7	Severe	Mild	High
Tunisia	32.3		Moderate	no data	None	
Western Sahara	no data			no data	None	

- Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood
- WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008
- Severity of anemia prevalence in a population with 5–19.9%, 20–39.9% and ≥40% referring to Mild, Moderate and Severe, respectively
- Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." PLoS Med 2(3): e67
- Severity of Hookworm- Extreme= 80–100%; Severe= 50–79.9%; Moderate= 30–49.9% ; Mild= 10–29.9%; Minimal= 0–9.9%
- High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/endemiccountries.html](http://www.rollbackmalaria.org/endemiccountries.html).
- WHO. World Malaria Report 2008. Geneva: WHO, 2008

Appendix 12b. Public health significance of anemia, malaria, and hookworm by country (continued)

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria	
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>	
<b>Africa (continued)</b>	<b>Western Africa</b>	Botswana	21.3	Moderate	Moderate	Low
		Lesotho	25.4	Moderate	no data	None
		Namibia	30.6	Moderate	Severe	Low
		South Africa	21.8	Moderate	Mild	Low
		Swaziland	24.3	Moderate	no data	Low
		Benin	72.7	Severe	no data	High
		Burkina Faso	68.3	Severe	Mild	High
		Cape Verde	41.3	Severe	no data	Elimination
		Cote d'Ivoire	55.1	Severe	Severe	High
		Gambia	75.1	Severe	Mild	High
		Ghana	64.9	Severe	Mild	High
		Guinea	63.2	Severe	Mild	High
		Guinea-Bissau	57.7	Severe	Mild	High
		Liberia	62.1	Severe	Extreme	High
		Mali	73.4	Severe	Mild	High
		Mauritania	52.7	Severe	Minimal	Low
		Niger	65.5	Severe	Mild	High
		Nigeria	66.7	Severe	Moderate	High
		Saint Helena	no data		no data	None
		Senegal	57.6	Severe	Mild	High
Sierra Leone	59.7	Severe	Mild	High		
Togo	50.2	Severe	Severe	High		
<b>Americas and the Caribbean</b>	<b>Caribbean</b>	Anguilla	no data		no data	None
		Antigua and Barbuda	29.5	Moderate	no data	None
		Aruba	no data		no data	None
		Bahamas	23.3	Moderate	no data	None
		Barbados	23.0	Moderate	no data	None
		British Virgin Islands	no data		no data	None
		Cayman Islands	no data		no data	None
		Cuba	39.1	Moderate	Mild	None
		Dominica	35.1	Moderate	no data	None
		Dominican Republic	39.9	Moderate	Minimal	Low
		Grenada	31.4	Moderate	no data	None
		Guadeloupe	no data		no data	None
		Haiti	63.2	Severe	Minimal	Low
		Jamaica	40.7	Severe	Minimal	Low

- Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood
- WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008
- Severity of anemia prevalence in a population with 5-19.9%, 20-39.9% and ≥40% referring to Mild, Moderate and Severe, respectively
- Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." *PLoS Med* 2(3): e67
- Severity of Hookworm- Extreme= 80-100%; Severe= 50-79.9%; Moderate= 30-49.9% ; Mild= 10-29.9%; Minimal= 0-9.9%
- High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/endemiccountries.html](http://www.rollbackmalaria.org/endemiccountries.html).
- WHO. World Malaria Report 2008. Geneva: WHO, 2008

Appendix 12c. Public health significance of anemia, malaria, and hookworm by country (continued)

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria	
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>	
Americas and the Caribbean (continued)	Caribbean (continued)	Martinique	no data		no data	None
		Montserrat	no data		no data	None
		Netherlands Antilles	no data		no data	None
		Puerto Rico	no data		Minimal	None
		Saint-Barthélemy	no data		no data	None
		Saint Kitts and Nevis	25.6	Moderate	no data	None
		Saint Lucia	33.4	Moderate	no data	None
		Saint Martin (French part)	no data		no data	None
		Saint Vincent and the Grenadines	32.7	Moderate	no data	None
		Trinidad and Tobago	29.7	Moderate	no data	None
		Turks and Caicos Islands	no data		no data	None
		United States Virgin Islands	no data		no data	None
		Central America	Belize	51.7	Severe	Minimal
	Costa Rica		27.9	Moderate	Minimal	Low
	El Salvador		10.5	Moderate	Minimal	Elimination
	Guatemala		22.1*	Moderate	Mild	Low
	Honduras		32.4	Moderate	Mild	Low
	Mexico		26.2	Moderate	Minimal	Elimination
	Nicaragua		32.9	Moderate	Minimal	Low
	Panama		36.4	Moderate	Mild	Low
	South America	Argentina	25.4	Moderate	Minimal	Elimination
		Bolivia	37.0	Moderate	Mild	Low
		Brazil	29.1	Moderate	Mild-Moderate	Low
		Chile	28.3	Moderate	no data	None
		Colombia	31.1	Moderate	Minimal	Low
		Ecuador	37.8	Moderate	Minimal	Low
		Falkland Islands (Malvinas)	no data		no data	None
		French Guiana	no data		Mild	Low
		Guyana	52.0	Severe	Mild	Low
		Paraguay	39.3	Moderate	Severe	Elimination
		Peru	42.7	Severe	Minimal	Low
	Suriname	32.4	Moderate	Mild	Low	
Uruguay	27.1	Moderate	Minimal	None		
Venezuela	39.6	Moderate	Minimal	Low		

1. Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood

2. WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008

3. Severity of anemia prevalence in a population with 5-19.9%, 20-39.9% and ≥40% referring to Mild, Moderate and Severe, respectively

4. Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." PLoS Med 2(3): e67

5. Severity of Hookworm- Extreme= 80-100%; Severe= 50-79.9%; Moderate= 30-49.9% ; Mild= 10-29.9%; Minimal= 0-9.9%

6. High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/endemiccountries.html](http://www.rollbackmalaria.org/endemiccountries.html).

7. WHO. World Malaria Report 2008. Geneva: WHO, 2008

Appendix 12d. Public health significance of anemia, malaria, and hookworm by country (continued)

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria		
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>		
<b>Asia</b>	<b>Northern America</b>	Bermuda	no data		no data	None	
		Canada	11.5	Mild		no data	None
		Greenland	no data			no data	None
		Saint Pierre and Miquelon	no data			no data	None
		United States of America	5.7	Mild		no data	None
	<b>Central Asia</b>	Kazakhstan	26.0	Moderate		Minimal	None
		Kyrgyzstan	34.1	Moderate		Minimal	Elimination
		Tajikistan	44.6	Severe		Minimal	Elimination
		Turkmenistan	29.9	Moderate		Minimal	Elimination
		Uzbekistan	53.8*	Severe		Minimal	Elimination
	<b>Eastern Asia</b>	China	28.9	Moderate		Minimal-Mild	Low
		DPR of Korea (North)	34.7	Moderate		no data	Elimination
		Japan	14.8	Mild		no data	None
		Mongolia	37.3	Moderate		Minimal	None
		Republic of Korea (South)	22.6	Moderate		no data	Elimination
	<b>Southern Asia</b>	Afghanistan	61.0	Severe		no data	Low
		Bangladesh	47.0	Severe		Moderate	High
		Bhutan	49.6	Severe		no data	Low
		India	49.7	Severe		Minimal-Mild	High
		Iran (Islamic Republic of)	40.5	Severe		Minimal	Elimination
		Maldives	55.4	Severe		no data	None
		Nepal	74.6	Severe		Moderate	Low
		Pakistan	39.1	Moderate		no data	Low
		Sri Lanka	29.3	Moderate		Mild	Elimination
	<b>South-Eastern Asia</b>	Brunei Darussalam	38.9	Moderate		Mild	None
		Cambodia	66.4	Severe		Severe	Low
		Indonesia	44.3	Severe		Mild	High
		Lao People's Democratic Republic	56.4	Severe		Mild	Low
		Malaysia	38.3	Moderate		Mild	Elimination
Myanmar		49.6	Severe		Minimal	High	
Philippines		43.9	Severe		Mild	Low	
Singapore		23.8	Moderate		Mild	None	
Thailand		22.3	Moderate		Moderate	Low	
Timor-Leste		22.9	Moderate		Mild	High	
Viet Nam	32.2	Moderate		Moderate	Low		

- Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood
- WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008
- Severity of anemia prevalence in a population with 5-19.9%, 20-39.9% and ≥40% referring to Mild, Moderate and Severe, respectively
- Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." PLoS Med 2(3): e67
- Severity of Hookworm- Extreme= 80-100%; Severe= 50-79.9%; Moderate= 30-49.9%; Mild= 10-29.9%; Minimal= 0-9.9%
- High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/endemiccountries.html](http://www.rollbackmalaria.org/endemiccountries.html).
- WHO. World Malaria Report 2008. Geneva: WHO, 2008

Appendix 12e. Public health significance of anemia, malaria, and hookworm by country (continued)

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria	
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>	
Asia (continued)	Western Asia	Armenia	12.0	Mild	no data	Elimination
		Azerbaijan	38.4*	Moderate	no data	Elimination
		Bahrain	27.7	Moderate	no data	None
		Cyprus	25.2	Moderate	no data	None
		Georgia	41.6	Severe	no data	Elimination
		Iraq	38.2	Moderate	Minimal	Elimination
		Israel	17.4	Mild	Minimal	None
		Jordan	38.7	Moderate	no data	None
		Kuwait	31.3	Moderate	no data	None
		Lebanon	31.6	Moderate	no data	None
		Occupied Palestinian Territory	no data		no data	None
		Oman	42.7	Severe	Minimal	None
		Qatar	29.1	Moderate	no data	None
		Saudi Arabia	32.0	Moderate	Minimal	Elimination
		Syrian Arab Republic	39.3	Moderate	no data	Elimination
		Turkey	40.2	Severe	no data	Elimination
		United Arab Emirates	27.9	Moderate	no data	None
		Yemen	58.1	Severe	Minimal	Low
		Europe	Eastern Europe	Belarus	25.8	Moderate
Bulgaria	29.7			Moderate	no data	None
Czech Republic	22.3			Moderate	no data	None
Hungary	20.7			Moderate	no data	None
Poland	25.3			Moderate	no data	None
Republic of Moldova	36.5			Moderate	no data	None
Romania	30.0			Moderate	no data	None
Russian Federation	20.8			Moderate	no data	None
Slovakia	25.2			Moderate	no data	None
Ukraine	27.3			Moderate	no data	None

1. Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood
2. WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008
3. Severity of anemia prevalence in a population with 5–19.9%, 20–39.9% and ≥40% referring to Mild, Moderate and Severe, respectively
4. Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." PLoS Med 2(3): e67
5. Severity of Hookworm- Extreme= 80–100%; Severe= 50–79.9%; Moderate= 30–49.9% ; Mild= 10–29.9%; Minimal= 0–9.9%
6. High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/endemiccountries.html](http://www.rollbackmalaria.org/endemiccountries.html).
7. WHO. World Malaria Report 2008. Geneva: WHO, 2008

Appendix 12f. Public health significance of anemia, malaria, and hookworm by country (continued)

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria	
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>	
<b>Europe (continued)</b>	<b>Northern Europe</b>	Åland Islands	no data	no data	None	
		Channel Islands	no data		no data	None
		Denmark	12.4	Mild	no data	None
		Estonia	22.7	Moderate	no data	None
		Faeroe Islands	no data		no data	None
		Finland	15.0	Moderate	no data	None
		Guernsey	no data		no data	None
		Iceland	11.8	Mild	no data	None
		Ireland	14.8	Mild	no data	None
		Isle of Man	no data		no data	None
		Jersey	no data		no data	None
		Latvia	25.0	Moderate	no data	None
		Lithuania	24.2	Moderate	no data	None
		Norway	9.3	Mild	no data	None
		Svalbard and Jan Mayen Islands	no data		no data	None
		Sweden	12.9	Mild	no data	None
		UK and Northern Ireland	15.2	Moderate	no data	None
		<b>Southern Europe</b>	Albania	34.0	Moderate	no data
	Andorra		15.5	Moderate	no data	None
	Bosnia and Herzegovina		34.8	Moderate	no data	None
	Croatia		28.4	Moderate	no data	None
	Gibraltar		no data		no data	None
	Greece		18.6	Moderate	no data	None
	Holy See		no data		no data	None
	Italy		15.5	Mild	no data	None
	Malta		26.1	Moderate	no data	None
	Portugal		17.3	Moderate	no data	None
San Marino	11.3		Mild	no data	None	
Serbia and Montenegro	33.6	Moderate	no data	None		
Slovenia	18.9	Mild	no data	None		
Spain	17.6	Mild	no data	None		
The former Yugoslav Republic of Macedonia	31.8	Moderate	no data	None		

1. Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood
2. WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008
3. Severity of anemia prevalence in a population with 5-19.9%, 20-39.9% and ≥40% referring to Mild, Moderate and Severe, respectively
4. Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." PLoS Med 2(3): e67
5. Severity of Hookworm- Extreme= 80-100%; Severe= 50-79.9%; Moderate= 30-49.9% ; Mild= 10-29.9%; Minimal= 0-9.9%
6. High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/endemiccountries.html](http://www.rollbackmalaria.org/endemiccountries.html).
7. WHO. World Malaria Report 2008. Geneva: WHO, 2008

Appendix 12g. Public health significance of anemia, malaria, and hookworm by country (continued)

		Maternal Anemia		Hookworm <sup>4</sup>	Malaria	
		Anemia Prevalence in Pregnant Women (%) <sup>1,2</sup>	Public health problem <sup>3</sup>	Public health problem <sup>5</sup>	Malaria control status and burden <sup>6,7</sup>	
<b>Europe (continued)</b>	<b>Western Europe</b>	Austria	15.5	Mild	no data	None
		Belgium	12.9	Mild	no data	None
		France	11.5	Mild	no data	None
		Germany	12.3	Mild	no data	None
		Liechtenstein	no data		no data	None
		Luxembourg	10.3	Mild	no data	None
		Monaco	6.3	Mild	no data	None
		Netherlands	12.5	Moderate	no data	None
		Switzerland	9.7	Mild	no data	None
<b>Oceania</b>	<b>Australia and New Zealand</b>	Australia	12.4	Mild	no data	None
		New Zealand	17.6	Moderate	no data	None
		Norfolk Island	no data		no data	None
	<b>Melanesia</b>	Fiji	55.6	Severe	no data	None
		New Caledonia	no data		no data	None
		Papua New Guinea	55.2	Severe	no data	Low
		Solomon Islands	51.1	Severe	no data	Low
		Vanuatu	57.3	Severe	no data	Low
	<b>Micronesia</b>	Guam	no data		no data	None
		Kiribati	38.4	Moderate	no data	None
		Marshall Islands	38.1	Moderate	no data	None
		Micronesia (Federated States of)	37.8	Moderate	no data	None
		Nauru	19.2	Mild	no data	None
		Northern Mariana Islands	no data		no data	None
	<b>Polynesia</b>	Palau	27.3	Moderate	no data	None
		American Samoa	no data		no data	None
		Cook Islands	27.2	Moderate	no data	None
		French Polynesia	no data		no data	None
		Niue	no data		no data	None
		Pitcairn	no data		no data	None
Samoa		33.4	Moderate	no data	None	
Tokelau		no data		no data	None	
Tonga		34.0	Moderate	no data	None	
Tuvalu	33.1	Moderate	no data	None		
Wallis and Futuna Islands	no data		no data	None		

- Anemia is defined as having a Hemoglobin concentration of less than 110g Hb / L blood
- WHO. Worldwide Prevalence of Anaemia 1993–2005. Ed. Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogswell. Geneva: WHO, 2008
- Severity of anemia prevalence in a population with 5-19.9%, 20-39.9% and ≥40% referring to Mild, Moderate and Severe, respectively
- Hotez PJ, Bethony J, Bottazzi ME, Brooker S, Buss P (2005) Hookworm: "The great infection of mankind." PLoS Med 2(3): e67
- Severity of Hookworm- Extreme= 80-100%; Severe= 50-79.9%; Moderate= 30-49.9% ; Mild= 10-29.9%; Minimal= 0-9.9%
- High= high contribution to global deaths, low= low contribution to global deaths, Elimination= pre-elimination and elimination of Malaria. Roll Back Malaria. Malaria Endemic Countries Map. July 26, 2010. [www.rollbackmalaria.org/ endemiccountries.html](http://www.rollbackmalaria.org/ endemiccountries.html).
- WHO. World Malaria Report 2008. Geneva: WHO, 2008





**A2Z: The USAID Micronutrient and Child Blindness Project**

Academy for Educational Development

1825 Connecticut Ave., NW

Washington, DC 20009 USA

[www.a2zproject.org](http://www.a2zproject.org)