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Building on Uganda's Progress in Reducing Anemia

A Landscape Analysis of Anemia and Anemia Programming in Uganda

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The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project is a five-year USAID-funded Cooperative Agreement to strengthen global and country efforts to scale up high-impact nutrition practices and policies and improve maternal and child nutrition outcomes. The project is managed by JSI Research & Training Institute, Inc., with partners Helen Keller International, The Manoff Group, Save the Children, and the International Food Policy Research Institute.

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Contents

Tables

Figures

Acronyms

ANC	antenatal care
CDP	Child Days Plus
DD	dietary diversity
DHS	Demographic and Health Surveys
dL	deciliter
DW	deworming
Fe	iron
g	gram
FHD	Family Health Days
HSSP	Health Sector Strategic Plan
IDA	iron deficiency anemia
IFA	iron–folic acid
ITN	insecticide-treated nets
IPT	intermittent presumptive treatment
IPTp	intermittent preventive treatment of malaria in pregnancy
HSSP	Health Sector Strategic Plan
IYCF	infant and young child feeding
GOU	Government of Uganda
MAAIF	Ministry of Agriculture, Animal Industries, and Fisheries
MAD	minimum acceptable diet
MOH	Ministry of Health
NA	not anemic
NGO	nongovernmental organization
NMCP	National Malaria Control Program
SAM	severe acute malnutrition
NMCP	National Malaria Control Program
RBM	Roll-Back Malaria
SP	sulfadoxine pyrimethane
SPRING	Strengthening Partnerships, Results, and Innovations in Nutrition Globally (project)
UBOS	Uganda Bureau of Statistics

UDHS	Uganda Demographic and Health Survey
UNHCR	United Nations High Commission for Refugees
WRA	women of reproductive age
6–23m	children 6 to 23 months old
24–59m	children 24 to 59 months old

Executive Summary

Background

Anemia, or low levels of hemoglobin, is one of the most common public health problems in the world today. It affects 25 percent of the world's population, more than 1.6 billion people (Benoist et al. 2008). About half of all anemia is due to iron deficiency, a condition caused by inadequate intake or low absorption of iron. Iron deficiency anemia (IDA) alone contributes to more than 100,000 maternal deaths and almost 600,000 perinatal deaths each year (Stoltzfus et al. 2004). Other causes of anemia include micronutrient deficiencies, intestinal helminthes, malaria, HIV infection, and hemoglobinopathies. Iron deficiency anemia and iron deficiency increase the risk of prematurity, preterm delivery, low birthweight, and maternal and child mortality; they reduce the cognitive and physical development of children, causes fatigue, and reduce the physical stamina and productivity of people of all ages. The prevalence and burden of anemia disproportionately affect young children and women of childbearing age (particularly pregnant women) in Africa and South Asia (Stevens et al. 2013).

In Uganda, anemia has been a major public health problem for many years. The earliest nationally representative anemia data are from the 2001 Uganda Demographic and Health Survey (UDHS). They indicated that 71 percent of children under five and 37 percent of women of reproductive age (WRA) were anemic. Five years later, these rates increased to 73 percent and 42 percent, respectively (Uganda Bureau of Statistics and ICF International, Inc. 2007). According to the World Health Organization (WHO), countries in which the national anemia prevalence rate is 40 percent or more have a "severe" public health problem. Since 2006, however, Uganda has made considerable progress in this area. The 2011 UDHS reported prevalence rates of 49 percent and 23 percent among children and WRA, respectively. This reflected reductions of 32 percent and 45 percent, respectively, and surpassed the Government of Uganda's (GoU) targets for 2016 (GoU 2011).

Rationale for the Study and Study Objectives

The purpose of this study was to better understand the factors contributing to the reduction in anemia prevalence and to inform anemia, nutrition, and health policies going forward. This included assessing the changes in the nature, coverage, and utilization of programs, as well as assessing changes in personal practices and behavioral patterns of Ugandan children (6–59 months old) and WRA (15-49 years old) over the past decade. Another objective of the study was to deliberate and develop consensus among stakeholders about which programs most likely contributed to reducing anemia. It was also hoped that this analysis would promote the development of a long-term participatory process of cross-program and multisectoral coordination that would encourage more integrated policy and program approaches that will improve the coverage, effectiveness, and efficiency of anemia-reductions efforts.

The specific objectives of the study were to—

- assess the plausibility that key anemia control and prevention programs contributed to the decline in anemia among children 6–59m and women of childbearing age by looking at changes in program coverage between 2001 and 2010
- foster an environment that encourages discussions about implementation challenges to anemia prevention and control efforts in Uganda.

Research Design and Methods

This study analyzed data from three UDHS surveys conducted in 2000-01, 2006, and 2011. In each survey, hemoglobin was collected and anemia prevalence was established. Hemoglobin levels were adjusted for altitude and were calculated separately for children 6–59 months and of women 15-49 years of age.

This study assessed trends in anemia and explored the plausibility of different programs having played a role in affecting the prevalence of anemia in two distinct populations: women of reproductive age (WRA) and children. Given that the types of anemia-related programs targeted to each of these populations differ, the discussion is structured into independent analyses of each of these populations.

Findings: Maternal Anemia

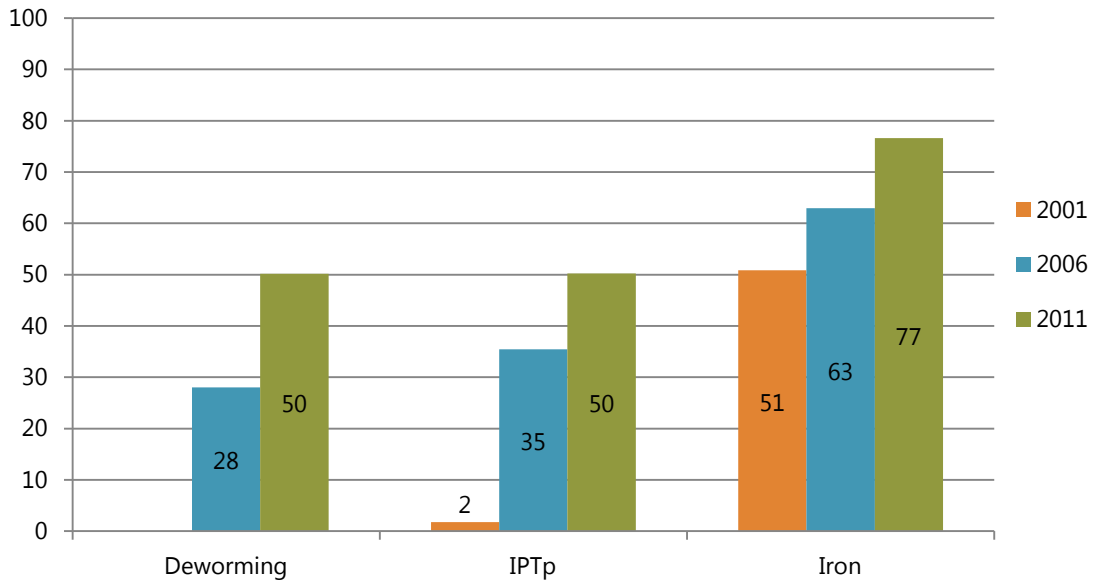
- WHO considers anemia to be a mild, moderate, or severe public health problem if prevalence among women is 5–19 percent, 20–39 percent, and greater or equal to 40 percent, respectively. After initially increasing from 36 percent in 2001 to 41 percent in 2006, the prevalence of anemia among WRA fell to 23 percent, making anemia a moderate public health problem in Uganda in 2011. More than two-thirds of the 18-point reduction in the prevalence of anemia between 2006 and 2011 was due to reduction in mild anemia.
- In 2011, anemia prevalence was lowest among women from the Western region, those with higher education, women who lived in urban areas, and women from the middle wealth quintile. The highest decline over the decade was seen among women living in the Western region. While the prevalence of anemia in Central and Eastern regions fell by one-third, in the Northern region, the proportion of anemia fell by 44 percent (leaving it with the second lowest in 2011), and Western rates fell by 63 percent. Another notable change from 2001 to 2011 was that differences in rural and urban women's anemia rates dramatically narrowed. While urban areas made significant progress—reducing anemia by about five percentage points during this period—the progress in rural areas was three-fold greater, as rural rates fell by 15 percentage points.
- Anemia in pregnancy remains a serious public health problem in Uganda. Antenatal care (ANC) is a widely used strategy to improve the health of pregnant women and serves as a platform for many maternal anemia interventions such as provision of deworming medicine, iron–folic acid (IFA) supplements, intermittent preventive treatment of malaria in pregnancy (IPTp) and distribution of insecticide-treated nets (ITN).[1] The Ministry of Health (MOH)'s ANC program, therefore, provides a particularly powerful mechanism for reaching the vast majority of pregnant Ugandan women.
- In 2001, ANC coverage was 94 percent and had reached 96 percent by 2011. However the first ANC visit continued to occur late in pregnancy, at five months. The percentage of women receiving any iron supplementation during pregnancy increased from 51 percent in 2001 to 77 percent in 2011. Similarly, the percent of women receiving any dose of IPTp rose from 2 to 50 percent over the same time period. Although the 2001 survey did not ask about deworming drugs, between 2006 and 2011 the proportion of women who received at least one dose during pregnancy nearly doubled. Despite the increase in ANC coverage, less than 10 percent of women were receiving the two or more doses of IPT, and less than half were receiving deworming medicine, indicating that policymakers may not understand the benefits of the anemia interventions in the ANC platform in Uganda. In addition, although the proportion of women receiving any

[1] Use of insecticide-treated nets (ITNs) is also recommended and the National Malaria Control Program's Strategic Plan calls for ITNs to be distributed during antenatal care clinic visits, but the DHS only asks about bed net use during the night prior to the survey, not during pregnancy.

iron supplementation improved steadily over the past decade, progress in the number of IFA tablets distributed has been slow.

- Apart from promotion of sleeping under an ITN and promoting iron-rich food consumption, Uganda does not implement targeted anemia prevention and control strategies for WRA outside ANC. IFA for adolescent girls is included in Health Sector Strategic Plan III, which has not yet been implemented in Uganda.

Figure 1. Among Women with a Birth in the Past Five Years, Percentage Reporting Receiving Various Anemia-Related Interventions during Pregnancy, 2001–2011



- Bed net ownership in Uganda increased from 42 percent in 2001 to 80 percent in 2011, and the proportion of women sleeping under bed nets the night before the survey more than doubled, from 26 to 55 percent. The increase in bed net ownership between 2001 and 2011 was accompanied by a modest increase in the rate of bed net use by owners, from 62 percent to 69 percent. Table 1 shows regional differences in bed net data. In 2001, the level of ownership of bed nets in the Western region was one-third the rate of the rest of the country. By 2006, the Western region had narrowed the gap, but its ownership rate was still only slightly more than half the rate in the rest of the country. Over the next five years, ownership rates surged in all regions of the country; those in Western outpaced all other regions and came to have a rate that surpassed that of Eastern and was equal to the national average of 80 percent.

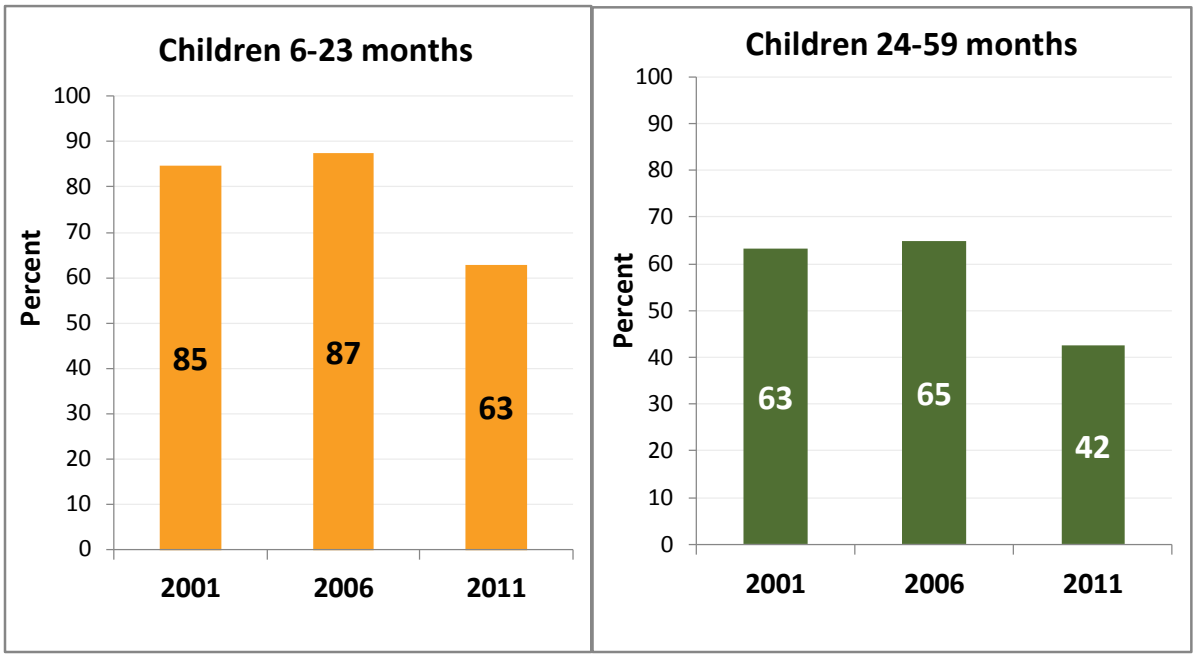
Table 1. Proportion of Non-Pregnant Women Owning a Bed Net, and among Those Who Own, the Percentage Who Slept Under One the Previous Night, by Region, 2001–2011

	2001		2006		2011	
	Ownership	Use	Ownership	Use	Ownership	Use
Central	16.9	44.8	48.3	58.8	84.1	67.7
Eastern	17.5	73.8	38.9	76.4	73.9	73.4
Northern	17.1	72.6	45.8	56.4	83.6	73.0
Western	5.7	43.0	25.6	62.3	79.8	62.1
Total	**14.3**	**61.0**	**39.1**	**63.1**	**80.1**	**68.6**

Findings: Child Anemia

- Anemia among children between 6–59 months increased slightly from 2001 to 2006, but declined significantly by 2011 (Figure 2). Among children 6–23 months, the prevalence of anemia did not change, but declined to 63 percent in 2011. Prevalence of anemia among children 24–59 months is lower, but shows a similar declining trend.

Figure 2. Anemia Prevalence among Children 6–23 Months (Left) and Among Children 24–59 Months (Right)

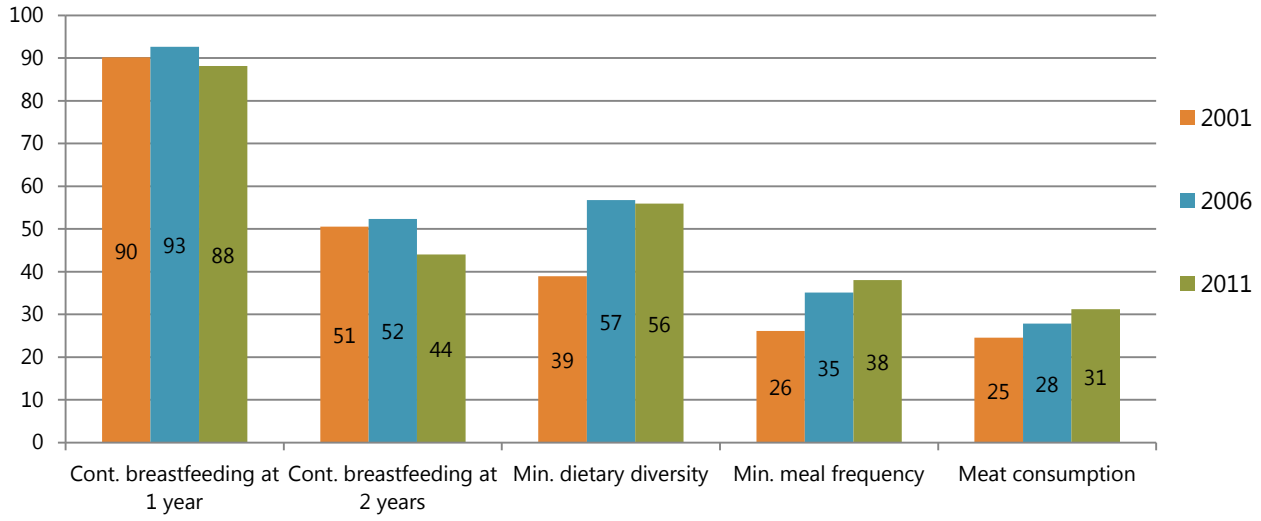


- In 2011, in both children's age groups, the prevalence of anemia varied significantly by highest educational level of mother, household wealth quintile, and region. The prevalence of anemia among children 6–23 months old whose mothers had no education showed a decrease from 86 percent in 2001 to 60 percent in 2011. Similarly, the prevalence of anemia among children 24–59 months old whose mothers had no education showed a decrease from 68 percent to 45 percent. The decline of anemia in both age groups was highest among children who belonged to the highest two wealth quintiles. Although Western children experienced the largest percentage point and percentage reductions in anemia prevalence from 2006 to 2011, they were already the lowest in 2001.

- Figure 3 summarizes trends in five selected indicators of feeding practices and dietary patterns that effect IDA in children 6–23 months: continued breastfeeding at one year; continued breastfeeding at two years; minimum dietary diversity; minimum meal frequency in the past 24 hours; and consumption of meat in the past 24 hours (as defined by WHO).[2] The figure above suggests that while breastfeeding rates have deteriorated over time, there have been marginal improvements in the other three infant and young child feeding practices over the last decade.

[2] Three IYCF practices (per breastfeeding) status refers to infant and young child feeding practices among children 6–23 months old living with their mothers, as established by WHO. The binary indicator takes into account food diversity (number of food groups), frequency of feeding; and consumption of breast milk or other milks and milk products and is restricted to the last-born child.

Figure 3. Feeding Practices and Dietary Patterns of Children 6–23 Months



- Figures 4 and 5 show trends in the participation of children in three anemia-related programs. The coverage of all three programs has grown each year, with the exception of vitamin A coverage among the younger children from 2006 to 2011. By far, the most dynamic program has been bed nets. Bed nets had the highest growth rates of any program in any year, and in the most recent survey in 2011, was the program with the highest coverage rate. The next-highest rate was that of vitamin A supplementation coverage. While the rate among the older children has increased, its pace lagged behind that of the younger age groups in 2006 and 2011. Although vitamin A coverage rates fell among the 6–23 month olds in 2011, it continued increasing among 24–59 month olds. Among the older children, the rates of coverage of deworming and vitamin A have varied by only one or two percentage points and have moved in tandem. The deworming rates have been relatively lower among the younger group, reflecting the fact that the program is limited to children 12 months of age and older.

Figure 4. Among Children 6–23 Months, Prevalence of Select Anemia-Related Behaviors, 2001-2011

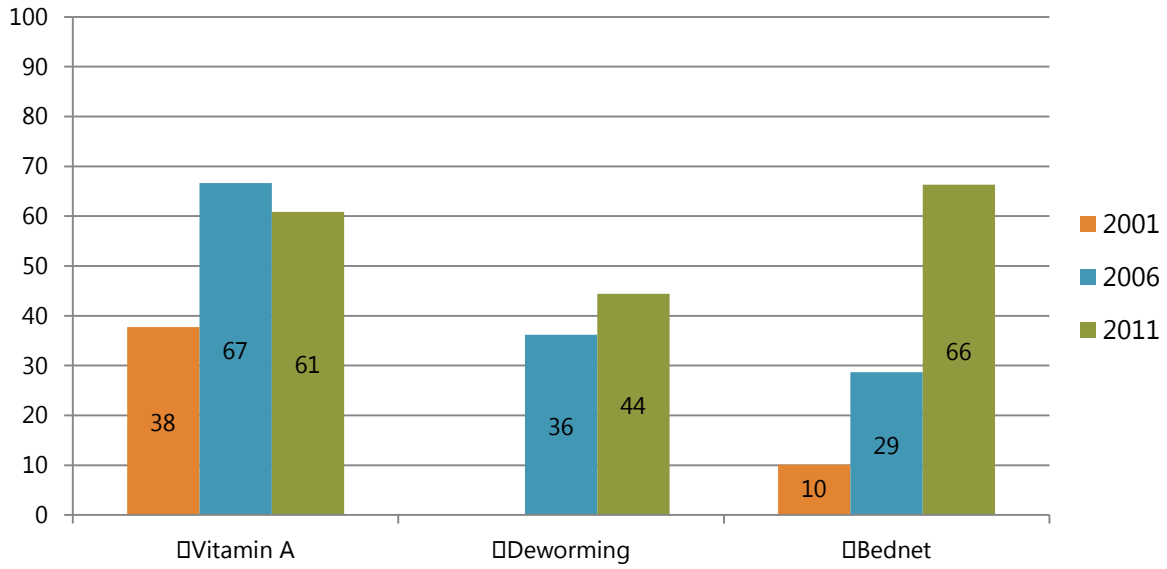
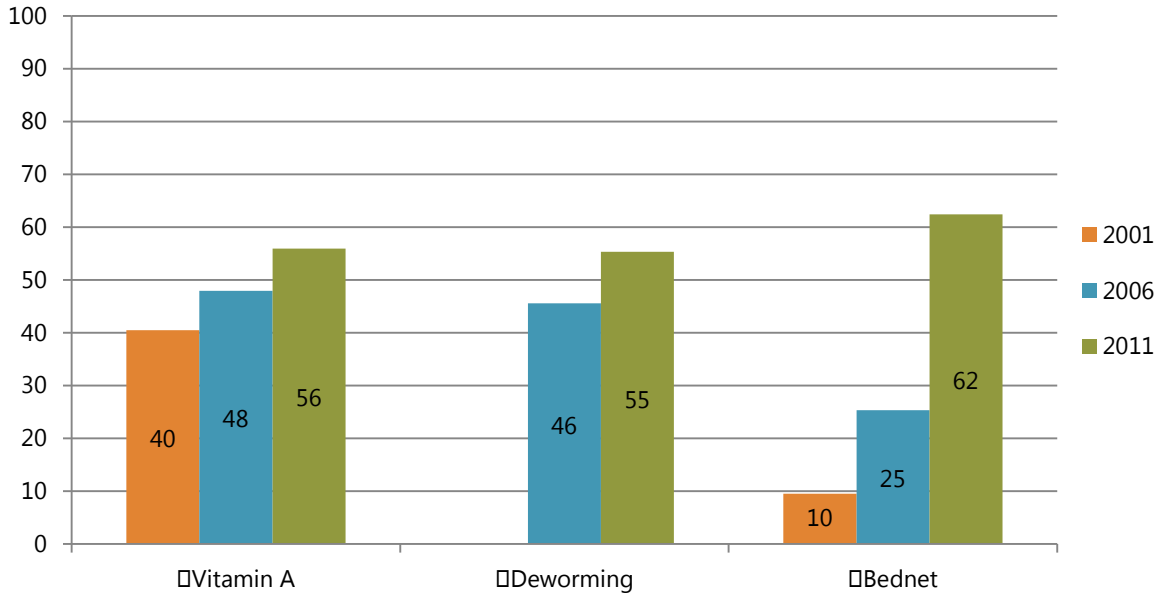


Figure 5. Among Children 24–59 Months, Prevalence of Select Anemia-Related Behaviors, 2001–2011



Discussion

Uganda has shown a remarkable reduction in anemia prevalence over the last five years. The reductions in anemia among children 6–59 months and among WRA reflect broad-based gains by all strata of the population since 2006 that more than offset the 2001-2006 increases in prevalence rates.

The findings from this study show that while the gains since 2006 have been enjoyed widely, the rates of decline in anemia prevalence have varied, with some groups and strata experiencing relatively greater gains. Most of women's gains have been in mild anemia, whereas among children—especially among the youngest children, 6–23m—there have been larger percentage point reductions and larger percentage declines in moderate and severe anemia. Based on the findings, several behaviors and programs may have contributed to reduction in prevalence of anemia among women and children over the last 10 years.

- Substantial increases in behaviors related to anemia reduction were seen in the large-scale ownership and use of insecticide bed net use among both WRA and children under five.[3] The changes in bed net use increased by 45 percentage points among women and 52 percentage points among children 6–59 months between 2001 and 2011.
- Among 6–59 months, there was a remarkable growth in the number of anemia-related programs and behaviors in which Ugandan children engage. In 2001, 43 percent of all 6–23 month olds and 48 percent of 24–59 month olds did not receive any anemia-relevant services. These percentages fell dramatically over the following decade, reaching roughly one-fifth that level in 2011, reflecting a major transformation in Ugandans' health-seeking behavior patterns. In 2006, the percentage of older children who did not participate in any program was 25 percent, nine percentage points higher than rate of younger children who did not participate in any programs, which was at 16 percent. At the same time, the number of children participating in all three programs went from nine to approximately 25 percentage points in

[3] It is important to highlight that bed net ownership and use questions were based on questions that asked about use the night before the interview, while other questions were based on use of services in the last five years before the survey. So there may be a slight recall bias with regard to some of the other service-use responses.

2011. Considering the three programs that children in both age groups have in common—deworming, vitamin A supplementation, and bed nets—among 6–23m olds, the average (mean) number of programs has gone from 1.31 in 2006 to 1.63, an increase of 24 percent, and among 24–59m olds, it has increased even more; from 1.28 to 1.71, an increase of 34 percent among children 6–23 months.

- The proportion of women receiving the three anemia-related ANC services also changed impressively in the last decade. In 2006, 12.7 percent of women reported that they had received IFA and IPTp services during their last pregnancy. In 2011, the percentage of women reporting they had received any two services increased from 26 to 3 percent. The percentage of women who reported receiving all three services more than doubled, from 11 percent in 2006 to 27 percent in 2011. The significant variation in the combinations of these services and the changing patterns with which they have been provided suggest that although the performance of ANC has improved steadily in the last decade, there remains substantial room for improvement.

Study results indicate that several strategies for anemia prevention and control are in place in Uganda. These include supplementation of women and children with iron and vitamin A, deworming, food fortification (particularly vitamin A-fortified oil), and strong malaria prevention and control programs. The proportion of women and children participating in anemia-related interventions has also increased in the last decade. However, a number of challenges to sustaining and improving these programs remain. The low coverage and participation of women and children in integrated maternal and child health programs may indicate a number of challenges with such programs, including issues related to quality of services, human and financial resources, provider capacity, awareness of anemia and related services, and other factors that may hamper the effective delivery of these services.

Despite having the focused ANC package and Child Days Plus (CDP) programs in place, the Ugandan health care system has not been able to fully commit to ensuring that all components of the package are implemented for a majority of the target populations. Poor financial resource allocation, inadequate human resources, poor management and quality of care are possible factors that confound the implementation of various integrated package components (Health Sector Strategic Plan II).

1.0 Introduction

1.1 The Global Anemia Situation

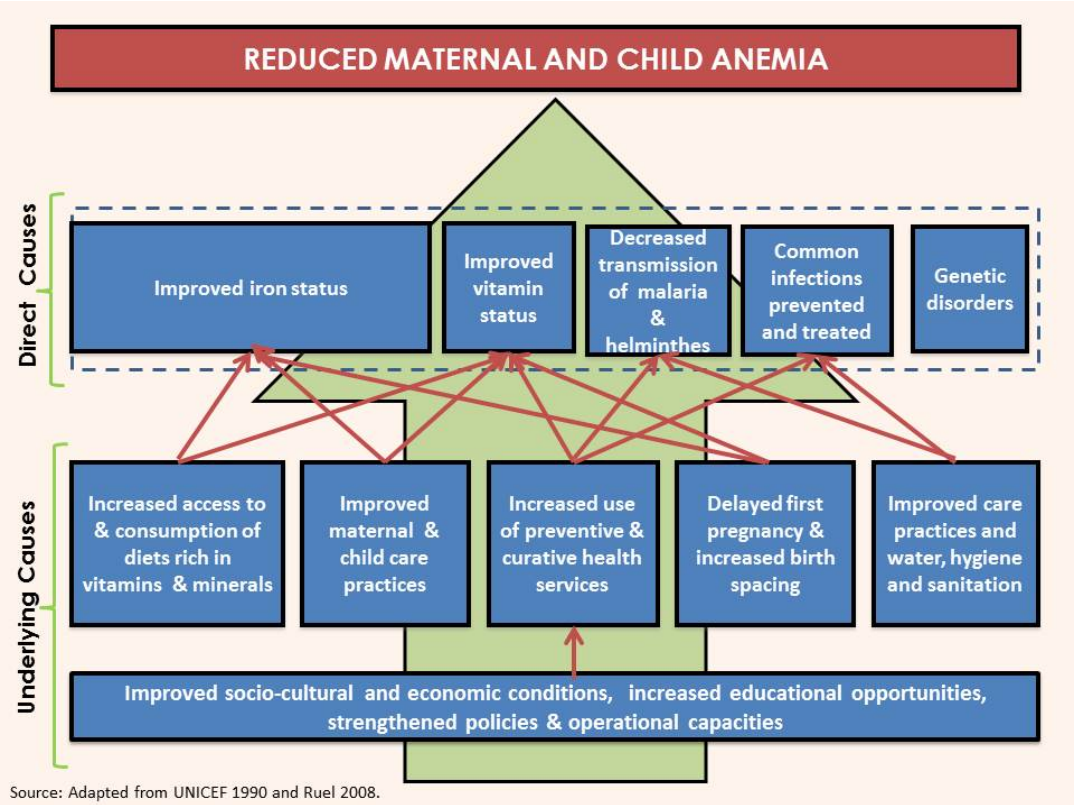
Anemia, or low levels of hemoglobin, is one of the most common public health problems in the world today. It affects 25 percent of the world's population, more than 1.6 billion people (Benoist et al. 2008). About half of all anemia is due to iron deficiency, a condition caused by inadequate intake or low absorption of iron. Iron deficiency anemia (IDA) alone contributes to more than 100,000 maternal and 600,000 perinatal deaths each year. Most of this impact is not limited to severe cases of anemia, but rather it occurs in mild and moderate cases ("Comparative Quantification of Health Risks: Global and Regional Burden of Disease Attributable to Selected Major Risk Factors" 2004). Anemia increases the risk of prematurity, preterm delivery, low birthweight, and maternal and child mortality; it reduces the cognitive and physical development of children, causes fatigue, and reduces the physical stamina and productivity of people of all ages. Economic losses due to IDA are estimated at $2.32 per capita, or 0.6 percent of gross domestic product (Horton 2008).

The prevalence and burden of anemia disproportionately affect the most vulnerable populations globally. In most developing countries of Africa and South Asia, between one-third and one-half of young children and women of childbearing age (particularly pregnant women) are anemic (Stevens et al. 2013). While there are many direct causes of anemia, IDA is more common during pregnancy and in infancy, when physiological iron requirements are highest and the amount of iron absorbed from the diet is not sufficient to meet many individuals' requirements (Stolzfus et al. 2004). Globally, 43 percent of children under 5, 38 percent of pregnant women, and 29 percent of non-pregnant women 15-49 years of age are anemic (Stevens et al. 2013).

Many factors affect hemoglobin levels and cause anemia as shown in Figure 1.1 The immediate causes include iron deficiency, other nutritional deficiencies, malaria, helminthes infections (particularly hookworm), chronic infections including HIV and tuberculosis, and causes related to reproduction and contraception and genetic disorders such as thalassemia and sickle cell (Galloway and McGuire 1994). The underlying causes include genetic, physiological, behavioral, and environmental variables.

Worldwide, iron deficiency causes 50 percent of anemia. However, this fraction is lower among children and in areas like sub-Saharan Africa, where malaria and other infections may have a bigger role in anemia's etiology. Given the multiple causes of anemia, it should not be surprising that there is a multitude of health and agricultural programs that are likely to affect the prevalence of anemia in a country.

Figure 1.1. Conceptual Framework Explaining the Immediate and Underlying Causes of Anemia



Source: Adapted from UNICEF 1990 and Ruel 2008.

1.2 The Anemia Situation in Uganda

Anemia has been a major public health issue in Uganda for many years. The earliest nationally representative anemia data are from the 2001 Uganda Demographic and Health Surveys (UDHS). They show 71 percent of children under-five and 37 percent of WRA were anemic. Five years later, these rates had increased to 73 percent and 42 percent, respectively (Uganda Bureau of Statistics [UBOS] and ICF International, Inc. 2007). According to the WHO, countries in which the national anemia prevalence rate is 40 percent or more are classified as having a "severe" public health problem of anemia.

Since 2006, however, Uganda has made impressive progress. The 2011 UDHS reported prevalence rates of 49 percent and 23 percent among children and WRA, respectively—reflecting dramatic reductions of 32 percent and 45 percent, respectively—and surpassing the Government of Uganda's (GoU) targets for 2016 (Government of Uganda 2011). These gains have generated interest among stakeholders and raised questions on what factors may have contributed to this reversal in the historical trajectory of anemia trends in Uganda. Ugandans are interested in understanding the environmental conditions, programs, behaviors, practices, and other influences that contributed to this impressive progress in the fight against anemia.

The purpose of this study is to analyze the changes in the nature, coverage, and utilization of the policies and programs, as well as changes in some of the personal practices and behavioral patterns of Ugandan children (6–59 months old) and women (15-49 years old) over the past decade to better understand the role of these factors in contributing to the reduction in the prevalence of anemia, and help inform anemia, nutrition, and health policies going forward.

1.3 Uganda's Anemia-Related Prevention and Control Programs Since 2000

The exact causes of anemia in Uganda are unknown, but evidence shows that genetic traits such as sickle-cell anemia and thalassemia, low bioavailability of iron in the diet, malaria, schistosomiasis and hookworm infections, other nutritional deficiencies, HIV, and poor sanitation are important determinants of low hemoglobin status among children under five and WRA in the East African region (Bhutta et al. 2008; Stevens, 2013).

The GoU's National Anemia Policy in 2002 marked a watershed in Uganda's recognition of the significance of anemia and its commitment to targeting it as a major health problem. The National Anemia Policy was prepared to guide and strengthen existing, ongoing interventions as well as improve coordination and collaboration between key players in anemia prevention and control efforts.

The following subsections provide a broad overview of the various complementary interventions for prevention and control of anemia in the areas of nutrition, maternal health, child health, malaria control, and food fortification.

Nutrition

In 2003, the MOH and Ministry of Agriculture, Animal Industries, and Fisheries (MAAIF) released a Food and Nutrition Policy (FNP) that first established the elimination of micronutrient deficiencies as a major objective and guiding principle in national nutrition policymaking that remains in effect to date. The policy itself and the subsequently issued strategic implementation plans (Uganda Food and Nutrition Strategy and Investment Plan [2005], Uganda Nutrition Action Plan [2010]) establish the prevalence of anemia as a performance indicator of nutrition policy (Uganda MAAIF and Uganda MOH 2004). The specific interventions identified in the strategy were not programs that focused exclusively on anemia reduction, but rather were more broadly focused on general malnutrition reduction among infants, women, and children. They included programs to improve access to and utilization of services related to maternal, infant, and young child nutrition; improve acute malnutrition case management; enhance diet diversification; increase food security, and promote social protection interventions for improved nutrition. While the first 1,000 days has received considerable attention in the Uganda Nutrition Action Plan (UNAP), the strategy does not highlight the special iron needs of children under two to build their iron stores and meet the requirements of rapid growth.[4]

Uganda's Child Survival Strategy (2009) similarly identified more broadly focused, high-impact nutrition interventions (FANTA-2 2010).

Maternal and Child Health Care

Mothers and young children have long been a crucial target group of the public health sector of Uganda. The Guidelines and Service Standards for Reproductive Health Services, released in 2001, include an integrated package with a broad range of services. It recommends a minimum of four antenatal care visits with screening for anemia and worms, IFA provision, deworming prophylaxis, intermittent preventive therapy (IPT) for malaria in

[4] Until six months of age, normal-weight, full-term infants who are born to healthy mothers and are exclusively breastfed receive enough iron from their own stored iron and from breast milk. Their stored iron is exhausted in about six months. Additional iron is then required because the iron content of unfortified conventional complementary foods is insufficient to meet the high iron requirements of growing 6–24-month-old infants and children. Infants and children who do not obtain adequate iron will suffer cognitive impairment that will affect their ability to learn and to perform income-earning tasks later in life. Iron supplements provided after 24 months of age may not correct this cognitive impairment.

pregnancy, and education about hygiene and infant feeding (Reproductive Health Division 2001). These services are critical for reducing the burden of anemia in pregnant women, which remains fairly high in Uganda.

The three iterations of the Health Sector Strategic Plan (HSSP, 2001-05, 2005-10, 2010-15), which are implementation plans for operationalizing Uganda's National Health Policy, have consistently recommended a comprehensive package of preconception, antenatal, and postnatal services. All three plans have included community-based health promotion as an integral part of the maternal and child health system. The second HSSP introduced the concept of the village health team as a bridge between communities and health facilities, and, more specifically, for disseminating appropriate practices for feeding, reproductive health, and infectious disease control, including malaria (FANTA-2 2010). The third HSSP established a minimum health care package that included a framework for guaranteed basic health services and a maternal health package of services that included IFA supplementation for postpartum women (Uganda MOH 2010).

One strategy for combating anemia that has not been reflected in official documents is delayed cord clamping, which simply allows blood to flow through the umbilical cord after birth for two to three minutes while initiating essential newborn care. This practice is recommended by WHO to prevent anemia in infants, but the policy has not been reflected in official MOH documents or included in government trainings.

Reproduction and Contraception

The reproductive cycle greatly increases a woman's requirements of iron. In pregnancy, iron requirements increase three-fold from expanding maternal red cell-mass and growing placenta and fetus. Because it is difficult to reach these requirements through iron-rich diets alone, a daily supplement with iron and folic acid is recommended for pregnant women as early as possible, or at least during the second and third trimester in countries where anemia is widespread. The period between pregnancies allows women to recover some of her iron supplies. Without birth spacing and without adequate diets of iron supplements, iron deficiency and anemia become more common (Balarajan et al. 2011).

The unmet need for family planning in Uganda was high at 41 percent in 2006 with less than 24 percent of women using a modern contraceptive. Fertility rates remain high and Ugandan women bear an average of 6.2 children over their lifetimes. Fertility rates have declined marginally from 6.7 children in 2001 to 6.2 children in 2012. Similarly, birth intervals did not change significantly between 2001 and 2011. The proportion of births with an interval of 48 months or more from the preceding birth increased from 13 to 16 percent between 2001 and 2011; while the proportion of births with an interval of less than 24 months decreased from 28 percent in 2001 to 25 percent in both 2006 and 2011 (GoU 2011).

A roadmap for accelerating reduction of maternal and neonatal mortality and morbidity was developed in Uganda in 2007 to increase the availability, accessibility, and utilization of skilled care during pregnancy and at childbirth and to strengthen family planning and service provision for men and women who want to space or limit childbearing. Strategies include strengthening the legal frameworks for maternal and newborn programs and improving access and utilization of care.

Child Days Plus and Family Health Days

In conjunction with iron deficiency, deficiencies of folic acid and vitamins A and B-12 also cause nutritional anemia. Vitamin A plays an important part in erythropoiesis and has been shown to improve hemoglobin concentration and increase the efficacy of iron supplementation (Balarajan et al. 2011).

When they first began in 2001, Child Days Plus (CDP) in Uganda was an outgrowth of polio's National Immunization Day activities, and was held in select districts. They consisted of twice-annual, campaign-based outreach activities designed to increase the coverage of critical high-impact services for young children. CDP services are provided in MOH facilities, primary and nursery schools, community centers, and in high-traffic, outdoor areas such as trading centers and markets. Initially, CDP focused on children 6–59 months of age for vitamin A supplementation, intermittent ITN distribution, and catch-up immunization. In 2004, the service package expanded to include deworming. Starting in 2006, CDP became a nationwide program and was mainstreamed into district health plans and primary health care funding (Mugyenyi, Mbabazi, and Kabwongera 2009). That year also marked the expansion in the program's target population: vitamin A supplementation remained targeted at children 6–59 months old, but the target population of deworming was expanded to include children up to 14 years, and CDP outreach sites came to include all primary schools (Fiedler and Semakula 2014; Alderman 2007). Since 2006, CDP has become more standardized and has gone from being an outreach activity occurring twice annually for a few days or a week, to one that lasts a full month twice a year (usually in May and November). The core services of CDP have become vitamin A and deworming, with specific catch-up immunizations provided at the discretion of each district and ITN distribution. The coverage of CDP has hovered around 60 percent of children 6–59 months (Mugyenyi, Mbabazi, and Kabwongera 2009).

In 2012, the concept of focused, periodic health campaigns was expanded from children to entire families. Expanded services included nutritional status assessments and antenatal and postnatal care, as well as programs unrelated to anemia reduction such as hypertension screening for people over the age of 45. Family Health Days (FHD) were initially focused on 20 poorly-performing districts, but there are plans to expand them to all districts in the country (Acheng 2012).

Malaria Control

The knowledge of the mechanisms of malaria-related anemia has increased substantially in the past decade and can be broadly attributed to decreased red-blood cell production and excessive blood cell destruction (Balarajan et al. 2011).

Uganda's National Malaria Control Program (NMCP) was established in 1995 to coordinate and strategize malaria prevention and treatment efforts. Its activities include indoor residual spraying, scaling up IPT, and improving clinical malaria diagnosis and case management (United States Agency for International Development [USAID] 2013). Although insecticide-treated nets (ITNs) were introduced to Uganda on a small scale in the early 1990s, the NMCP incorporated them into national policy in 1998. The initial NMCP policy, (Strategic Plan for 2000/01-2004/05), focused its pregnant women strategy on IPT.

In its second Strategic Plan (2005/06-2009/10), the NMCP added ITN distribution and education during ANC visits. ITNs were distributed free-of-charge to targeted groups—pregnant women and children—during mass campaigns, and one of the NMCP's goals became universal coverage of ITNs (defined as one net for every two people)(Balayo 2005). This change was seen as a strategy for increasing coverage among pregnant women and improving ANC uptake and the average number of ANC visits(National Malaria Control Programme 2005). In addition, it reinforced the provision of an integrated package of ANC services, and given its high level of funding, helped to routinize the provision of a more complete complement of the services in the ANC package. Box 1 below shows the evolution of WHO-recommended policies and strategies in Uganda.

Box 1. Malaria Interventions and Strategies in Uganda

The Evolution of Uganda's Malaria Intervention Policies and Strategies

Intervention	*WHO- recommended*	*Yes/ No*	*Year Adopted*
1. ITN/LLIN	1a. Distributed free-of-charge	Yes	2006
	1b. Distributed to all age groups	No	--
2. IRS	2a. Recommended	Yes	2005
	2b. DDT is used	No	--
3. IPT	3. Used to prevent malaria during pregnancy	Yes	2000
4. Case Management	4a. Patients of all ages receive diagnostic test	Yes	1997
	4b. RDTs used at community level	Yes	--
	4c. ACT is free for all ages in public sector	Yes	2006
	4d. Pre-referral treatment with recommended medicines	Yes	2002
	4e. Marketing authorization for all oral artemisinin-based montherapies withdrawn	Yes	2005

Source: World Malaria Report 2012: p.184.

Notes: ITN: insecticide-treated net. LLIN: Long-lasting insecticide net. IRS: indoor residual spraying. IPT: intermittent preventive therapy.

Food Fortification and Biofortification in Uganda

In the mid-1990s, the GoU acknowledged food fortification programs as a method to combat micronutrient deficiencies. Universal mandatory salt iodization was instituted in 1994. In the early 2000s, the MOH with USAID support commissioned a study that examined consumption patterns to search for evidence that would justify the fortification of commonly consumed foods. Initially, oil and maize flour were assessed as possible vehicles for vitamin A fortification. While maize flour had limits because of the lack of large-scale producers within the country, oil represented an ideal industry for a large-scale, countrywide fortification intervention. By 2005, up to 85 percent of vegetable oil was fortified with vitamin A (Kyamuhangire et al. 2013). In 2011, the GoU directed industries to fortify wheat and maize flour with iron, mandating medium- and large-scale wheat and maize flour producers to fortify their entire product with iron, folic acid, B12, and six other micronutrients. By July 2013, 11 of the 13 wheat flour millers in Uganda were fortifying, although there has been no assessment of how well they are complying with the regulation (Muthee 2012). Wheat flour fortification covers about 20 percent of the Ugandan population. Only four of the estimated thousands of mills that produce maize flour in Uganda, however, are mandated to fortify their product, as the mandate is limited to those producing at least 20 metric tons per day. Thus, while maize flour appears to be a promising fortification vehicle (given that 62 percent of Ugandans purchase maize flour), it is estimated that only 10 percent of the maize flour purchased is fortified, resulting in its very limited coverage and limiting any impact on anemia (Fiedler et al. 2014). Additional effort is required to promote both fortified maize flour production and demand.

Another method of increasing the nutritional content of foods is biofortification. Foods currently under research for micronutrient enrichment in Uganda include bananas, maize, beans, and rice. This effort is both a public and private endeavor, as both the National Agricultural Research Organization (NARO) and HarvestPlus are heavily involved in biofortification.

Integrated Service Packages and Cross-cutting Anemia-related Programs

There is broad scientific consensus on the efficacy of combination of programs and strategies to prevent and treat major causes of anemia along the continuum of care, with a specific focus on high-risk population groups such as pregnant women and children under two years of age. However, several barriers, such as insufficient political

priority, limited financial commitment for anemia, lack of institutional and operational capacity, and limited knowledge on how to integrate anemia into existing programs frequently impede countries from scaling up anemia prevention and control interventions (Balarajan et al. 2011).

In Uganda, programs to reduce maternal and child anemia have undergone many changes over the past decade. Combination interventions have increased, with many of them being delivered through integrated service packages. Yet the quality of the service packages—the consistency with which those programs and their component services are implemented across the country—is unreliable or subpar. This trend— particularly evident in ANC and CDP programs over the past decade—complicated the analysis of anemia-related health interventions over time.

Government of Uganda Partner Activities and Support for Anemia-Related Projects

Many programs run by nongovernmental entities address the multiple causes of anemia with different types of health services and interventions. For example, in addition to nutrition interventions, the United Nations High Commission on Refugees (UNHCR's) anemia strategy for refugee populations includes improving existing antenatal care and ITN distribution systems. The UPHOLD project, which took over USAID-supported micronutrient programming from A2Z in 2006, also implemented community-based solutions for poor feeding practices, increased antenatal care uptake, and promoted ITN use (FANTA-2 2010; MOST, The USAID Micronutrient Program 2005; JSI Research & Training Institute, Inc. 2013; The Manoff Group 2013). Finally, United Nations Children's Fund (UNICEF) has similarly promoted IPT, deworming prophylaxis, and water and sanitation programs alongside its nutrition strategies (FANTA-2 2010).

In recent years, several nongovernmental organizations (NGOs) have been involved in efforts aligned with national nutrition policy. UNICEF, for example, finances and provides technical assistance for severe acute malnutrition (SAM), provides technical and financial assistance to CDP and FHD, infant and young child feeding (IYCF), maternal child micronutrient supplementation, and nutrition surveillance and assessment. Other NGOs involved in anemia-related efforts include the World Food Programme (food supplementation in food-insecure areas); FANTA (nutrition assessment and counseling and general nutrition system strengthening); Save the Children (breastfeeding promotion and other newborn care initiatives); Food for Peace; GAIN (advocacy for national food fortification); The Global Fund (food and nutrition support for people living with HIV and AIDS); and the USAID Micronutrient Program (MOST and A2Z), which funded research and engaged selected districts in anemia-related training and communications activities, as well as food fortification (FANTA-2 2010). The nutrition activities of the UNHCR in Uganda focus on anemia reduction through distribution of therapeutic foods, multiple micronutrient powders, and the treatment of malnutrition (The UN Refugee Agency 2008).

1.4 SPRING in Uganda

USAID's Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project, a five-year cooperative agreement, is charged with addressing anemia and stunting worldwide. In Uganda, SPRING's activities include nutrition-related policy advocacy at the national level, health care workforce training and supervision, and behavior change communication among caretakers of children. SPRING has capitalized on its in-country capacity and presence to help the GoU strengthen its anemia prevention and control activities. One outcome of this analysis has resulted in the Anemia Action Plan, which reflects the complex etiology of anemia in Uganda, drawing from different sectors and divisions. As such, the plan addresses challenges in the implementation of anemia

control sector-by-sector, as identified through a process that included high-level discussions on the findings of the following landscape analysis during a stakeholder meeting in October 2013.

1.5 Rationale for the Study and Study Objectives

Many types of programs in both the health and social sectors can impact anemia prevention and control efforts. The main objective of this study was to systematically review the progress and changes in anemia-related interventions in Uganda. Another objective of the study was to develop consensus among stakeholders about which programs have been the most likely contributors to reducing anemia in Uganda. The ultimate aim is to promote the development of a long-term, ongoing, participatory process of cross-program and multisectoral coordination that will encourage more integrated and synergistic policy and program approaches to anemia to improve their coverage, effectiveness, and efficiency.

The specific objectives of the study were to—

1. assess the plausibility that key anemia control and prevention programs contributed to the decline in anemia among children 6–59 months of age and women of childbearing age by looking at changes in program coverage between 2001 and 2010
2. provide a forum to discuss implementation challenges around anemia prevention and control efforts in Uganda.

1.6 Organization of the Report

The remainder of the report is organized as follows: Section 2 describes the data, research design, and methodology. Section 3 describes trends in level and severity of anemia among WRA and examines their anemia-related behaviors and practices as well as those of pregnant women. It also analyzes the participation of pregnant women in the anemia-related aspects of antenatal care. Section 4 describes trends in the level and severity of anemia among children 6–59 months old, and their participation in various anemia-related prevention and control programs. Section 5 summarizes the main findings and presents the study's conclusion.

2.0 Data and Methods

2.1 Data Source

The data analyzed for this study come from Demographic and Health Surveys (DHS), which are population-based surveys that provide nationally and regionally representative information on socio-demographic characteristics, health and nutrition status, health service utilization, and other health-related behaviors of WRA and children 6–59 months. This analysis is based on the Uganda DHS surveys conducted in 2000-01, 2006, and 2011. In each, blood samples were collected via finger or heel prick in a microcuvette, and HemoCue instruments were used to measure hemoglobin levels and estimate anemia rates, adjusted for altitude, for children 6–59 months and women 15-49 years of age. Each of the three DHSs analyzed here was an independent, cross-sectional survey. The sample sizes are shown in the table.

Table 2.1. Study Population Analyzed, 2001-2011

UDHS Population	2000-01	2006	2011
A. Women 15–49 years old			
1. Women of reproductive age in the UDHS sample	7246	8531	8674
2. Women of reproductive age with hemoglobin results	6485	2817	2649
3. Women of reproductive age who were pregnant during the anemia test	786	340	282
B. Children 6–59 months old			
1. Children 6–23 months	2122	2367	2218
2. Children 6–23 months with hemoglobin results	1874	784	678
3. Children 24–59 months	3561	4415	4340
4. Children 24–59 months with hemoglobin results	2785	1326	1380
5. Total children 6–59 months with hemoglobin results	4659	2110	2058

2.2 Study Populations and Methods

This study discusses trends in anemia and explores the plausibility of different programs having played a role in affecting the prevalence of anemia in two distinct populations, women and children. Descriptive analyses were conducted for each of the subpopulations. While univariate analysis was used to examine levels and trends in anemia and anemia severity, bivariate analysis were used to explore associations between anemia and background characteristics. Behaviors that were hypothesized to have been associated with anemia prevention or control, such as sleeping under a bed net and attending a Child Day Plus program, were also investigated. Given that the types of anemia-related programs targeted to WRA and children under five differ, the discussion is structured into independent analyses of each of these populations.

Women of Reproductive Age

Hemoglobin levels of WRA (15-49 years old) were analyzed for each of the three surveys. The DHS did not ask questions on a number of possible behaviors, such as nutrient intake or infections status, or programs that could

potentially affect anemia among women who were not pregnant. Furthermore, although the DHS asked several questions about antenatal care related to maternal anemia, in any given survey about 12 percent of women were pregnant at the time of the interview. As a result, the background characteristics of the prevalence of anemia have been analyzed for all WRA, while the program participation mainly focuses on the antenatal care-seeking behavior among women who have had a child in the past five years. The severity of anemia levels and the risks of anemia over time were also analyzed for all women in the sample.

Children

The analysis of children under five years of age included calculating their prevalence rates of anemia, as well as the two additional analyses of hemoglobin levels that were conducted for women. As in the analysis of women, anemia-related program participation levels were analyzed in an attempt to identify plausible factors that may have contributed to the observed trends.

The research team also disaggregated the analysis of children into two age groupings; 6–23 months (6–23m) and 24–59 months (24–59m). We conducted separate analyses of these two groups because children 6–23m: 1) are known to be particularly susceptible to anemia (Soares Magalhães and Clements 2011); 2) have different nutritional recommendations; and 3) because preliminary analysis empirically demonstrated the different prevalence rates of these two groups, which motivated us to explore the nature of these differences in an attempt to better understand their dynamics and causes. (None of the UDHS surveys collected blood samples from children under six months of age.)

The selection of variables for the study was informed by previous literature on the determinants of prevalence of anemia in developing countries. In addition, the choice of variables was informed by women and children's coverage in programs that are related to the direct causes of anemia, as shown in the conceptual framework in Figure 1.1. The construction of the variables and their description is shown in Table 2.2.

Table 2.2. Description of Variables Used in the Study

Variable name	Type	Description
Outcome variable		
Prevalence of anemia	Categorical	Defined based on adjusted hemoglobin levels. Hemoglobin levels are adjusted for altitude among children and women as well as for smoking status in the latter.[5] Anemia prevalence has been divided into four categories based on hemoglobin levels: severe, moderate, mild, and no anemia. The hemoglobin cut-off levels among children, non-pregnant, and pregnant women are as follows: Children and pregnant women Severe anemia- <7.0 g/dL Moderate anemia- 7.0-9.9 g/dL Mild anemia- 10.0-10.9 g/dL No anemia- ≥11g/dL Non-pregnant women Severe anemia- <7.0 g/dL Moderate anemia- 7.0-9.9 g/dL Mild anemia- 10.0-11.9 g/dL No anemia- ≥12g/dL
Independent variables		
Regions	4 categories: Central, Eastern, Northern, and Western	Geographic areas differed across the three surveys and have been regrouped into four regions to allow for comparisons across surveys. In the 2006 and 2011 surveys, Central 1, Central 2, and Kampala are grouped as Central region; east Central and Eastern as Eastern; north and West Nile as Northern; and Western and southwest as Western region. Karamoja was added to Northern region in 2011 survey. Note that the districts of Amuru, Bundibugyo, Gulu, Kasese, Kitgum, and Pader were not surveyed in the 2000-2001, so conclusions on regional comparisons should be drawn with caution.
Wealth	5 categories: poorest; poorer; middle; richer; richest.	Wealth quintiles were generated using principal components analysis.

[5] As compared to people living at sea level, those living at higher altitudes have higher hemoglobin and hematocrit levels due to low partial pressure of oxygen. Similarly, smoking increases hemoglobin levels because it interferes with blood's capacity to transfer oxygen.

Variable name	Type	Description
Age groups women	7 categories: 15-19; 20-24; 25-29; 30-34; 35-39; 40-44; and 45-49.	WRA were categorized into 5-year intervals 15 years to 49 years.
Age groups children	2 categories; 6–23 months; 24–59 months	Children were divided into two groups depending on whether they were between 6–23 months or 24–59 months.
Highest education level	4 categories: no education (reference group); primary; secondary; and higher.	This refers to the respondent's level of education or, in case of children, the mother's education.
Place of residence	Dummy: 0 for urban; 1 for rural	Urban was defined as '0' and rural was defined as '1'.
Bed net use	Dummy: 0 if a child did not sleep under a bed net the previous night; 1 if s/he did.	Among WRA and children, defined as whether the respondent said she/her child slept under a bed net the previous night.
Bed net ownership	Dummy: 1 if household owns bed net; 0 if not.	Among WRA and children, bed net ownership was explored at the household level. Of the respondents who report that their household owns a bed net, further analysis examines how many of them slept under the bed net the previous night.
Hormonal contraceptive use	Dummy: 1 if the woman was using at the time of the survey; 0 if not	Among non-pregnant women, if the woman was using pills, an intrauterine device, injections, or implants as a contraceptive method.
Birth spacing	Dummy: 1 if a woman had a birth in less than 24 months; 0 if not.	Among women with at least two births, birth spacing is a binary indicator on whether a woman ever had a birth in less than 24 months subsequent to the previous childbirth. It includes all past births in a woman's history.
Deworming medication	Dummy: 1 if at least one dose was taken; 0 if not.	Among women who gave birth in the past five years, drugs for intestinal parasites' was assessed as yes if the respondent had received at least one dose of de-worming medication during her last pregnancy.
Antimalarial prophylaxis during pregnancy	Dummy: 1 if at least 1 dose was taken; 0 if none.	Among women who gave birth in the past five years, assessed as 'yes if the woman had intermittent preventive treatment against malaria during her last pregnancy. Although the IPT program was introduced in 2002, the 2001 DHS included a question on whether the woman had taken any antimalarial tablets during pregnancy for

Variable name	Type	Description
		preventive purposes and the type of drug taken.
Iron supplementation during pregnancy	Dummy: 1 if yes; 0 if no.	Among women who gave birth in the past five years, determined by whether the woman was given or bought iron tablets or syrup during her last pregnancy.
Number of days of iron supplementation	3 categories: never; less than 90; more than 90.	Among women who gave birth in the past five years, the number of days a woman took iron supplementation during her last pregnancy.
Continued breastfeeding at 1 year	Dummy: 1 if a child was breastfed; 0 if not.	Refers to whether the child,12–15 months of age received breastmilk during the previous day. The base population for this indicator is restricted to the last-born child living with his/her mother.
Continued breastfeeding at two years	Dummy: 1 if a child was breastfed; 0 if not	Refers to whether the child 20-23 months of age received breastmilk during the previous day. The base population for this indicator is restricted to the last-born child living with his/her mother.
Minimum dietary diversity	Dummy: 1 if 6–23.9m received food from four or more food groups; 0 if not.	Dietary diversity refers to the child receiving four or more of the following food groups: Grains, roots, and tubers Legumes and nuts Dairy products (milk, yogurt, cheese) Flesh foods (meat, fish, poultry, and liver/organ) Eggs Vitamin A-rich fruits and vegetables Other fruits and vegetables
Minimum meal frequency	Dummy: 1 if breastfed and non-breastfed 6–23.9m received solid, semi-solid, or soft foods, or milk feeds the minimum number of times or more; 0 if not	Minimum meal frequency is defined: 2 times for breastfed 6–8 m 3 times for breastfed 9–23m 4 times for non-breastfed 6–23m
Meat consumption	Dummy:1 if children 6–23.9m consumed meat or flesh foods within the past 24 hours; 0 if not.	If the child 6–23 months received flesh food.
Vitamin A in last six months	Dummy: 1 if a child took a supplement; 0 if not.	Assessed by a single "yes/no" question indicating whether the child had received a vitamin A supplement in the six months preceding the survey. This information

Variable name	Type	Description
		was collected for 6–59m.
Deworming in the last six months.	Dummy: 1 if a child took medication; 0 if not.	Drugs for intestinal parasites' is assessed by a single "yes/no" question that indicates if the child received deworming medication in the six months preceding the survey. This information was collected for children 12-59m in the 2006 and 2011 DHSs.

2.3 Limitations

Because this study has several limitations, the findings should be interpreted with caution. The first limitation is that participation in programs was self-reported and as a result, prone to bias due to social desirability and recall. Second, because the data came from cross-sectional surveys, changes in anemia prevalence cannot be causally linked to any of the changes in anemia-related program coverage or participation rates, or to changes in anemia-related behaviors. This is also because changes could have been due to external factors like reduced morbidity/mortality and improved socioeconomic conditions. Third, since anemia is a complex disease with multiple etiology and DHS data does not have information on many of the factors that contribute to anemia, nor on all the programs that prevent and control for anemia (such as fortified oil and other dietary information), the analysis fails to capture the nuances of all causal pathways of anemia prevalence. Fourth, certain programs that have been promoted for pregnant women (slept under bed net) have been analyzed for non-pregnant women, owing to the time-frame used in the surveys. Finally, dietary information was not available for women respondents in 2006 and 2011 surveys, so it has not been analyzed.

3.0 Results: Women of Reproductive Age

The following section describes the findings of the changes in anemia prevalence among all WRA in Uganda and looks at changes in behaviors and service use patterns across time. It has been further sub-divided into three sections. The first explains trends in prevalence among WRA and describes the changes in prevalence by various background characteristics. The second section describes women's participation in various anemia-related interventions. The third section describes antenatal care (ANC) use and participation in anemia-related interventions during ANC among women who have had at least one birth in the five years preceding the surveys.

3.1 Trends in Anemia Prevalence

Figure 3.1 presents the prevalence of anemia among women 15-49 years based on hemoglobin levels. After initially increasing from 38 percent in 2001 to 43 percent in 2006, the prevalence of anemia among Ugandan WRA fell sharply to 23 percent in 2011.

Figure 3.1. Prevalence of Anemia among WRA, 2001-2011

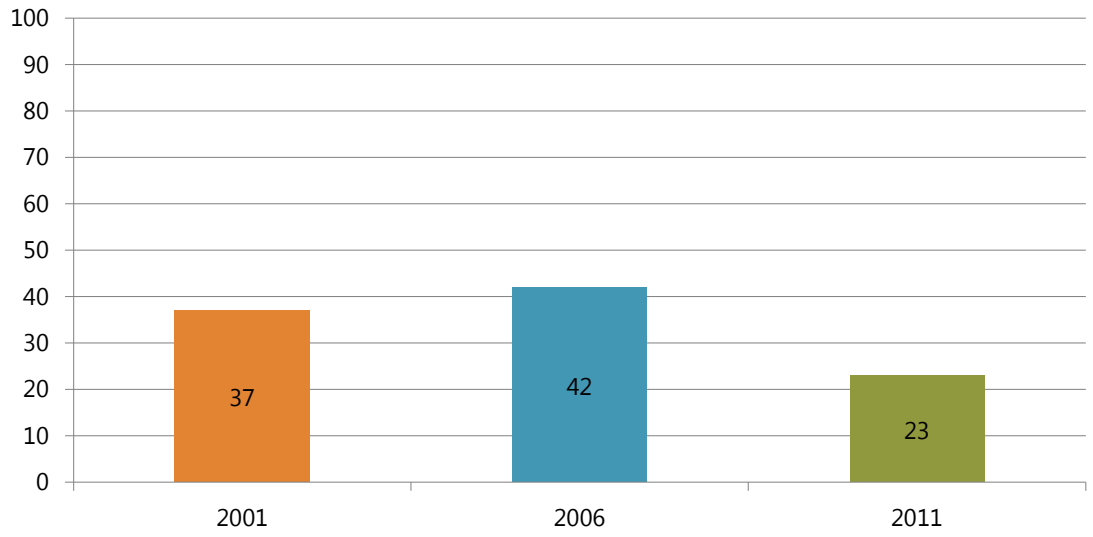


Figure 3.2 presents the prevalence of anemia by severity level among WRA. The greatest reductions in the type of anemia were seen in mild anemia, which decreased from 26 percent to 18 percent among WRA between 2001 and 2011. Mild anemia is the most common level of severity of anemia, accounting for 72 percent of the total anemia in 2006. Proportionately, however, the largest declines were in moderate anemia, which fell from a total of 10 to just five percent of women between 2001 and 2011— a reduction of 50 percent. Less than one percent of women had severe anemia in Uganda. The proportion of women who were not anemic increased from 62 percent in 2001 to 77 percent in 201—an increase of 14 percentage points.

Figure 3.2. Prevalence of Anemia by Severity Level among Women 15-49 Years of Age, 2001-2011

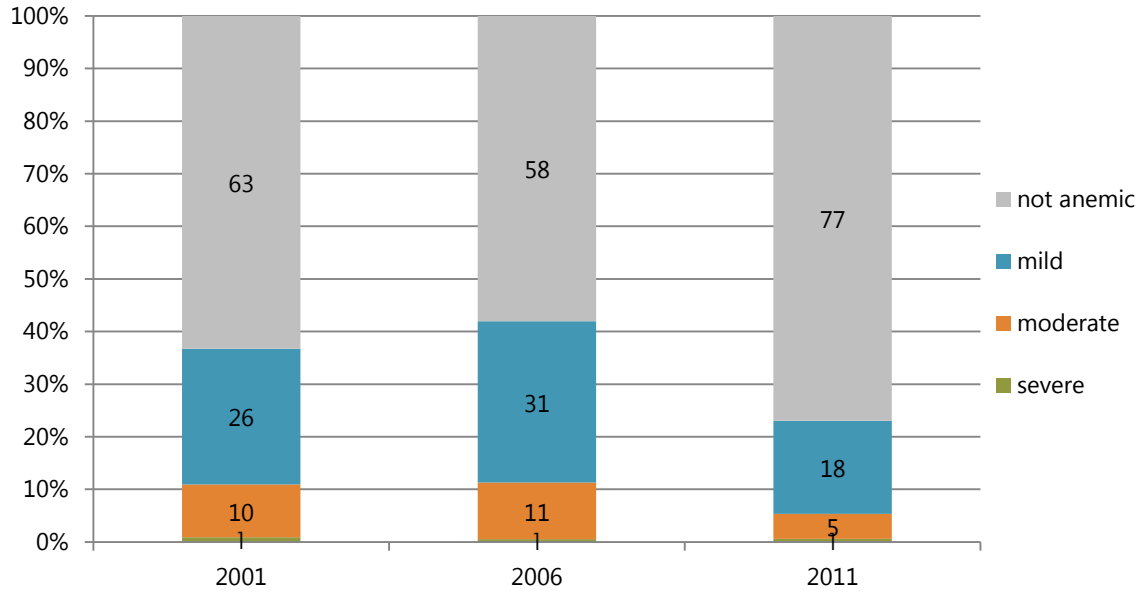


Table 3.2 presents data on the prevalence of anemia among women stratified by various background characteristics for each survey. In 2011, anemia prevalence was lowest among women from the Western region, those with higher education, living in urban areas, and from the middle wealth quintile. In some cases, the changes in the prevalence of anemia that occurred over the 2001-2011 period were such that systematic relationships between certain characteristics and the rates of anemia remained unchanged, as rates of change were roughly proportional. For instance, the prevalence rates among adolescent women remained lowest among all of the age groups, while the highest rates were among women 35 and older, and the difference between the adolescents' prevalence rates and that of oldest age groups remained largely unchanged, at roughly 10 percentage points. Similarly, the anemia rates of women who had not had any children relative to those with one or more remained lower and the differential remained roughly constant in terms of the prevalence rate, while increasing in percentage terms.

There were other characteristics, however, for which the pace of progress over the past decade varied over time, resulting in several distinct and noteworthy trends. For instance, in 2006, both Western and Northern regions had the highest levels of anemia among women. That year, Central and Eastern each had lower rates of approximately 40 percent. Between 2006 and 2011, the greatest reductions in anemia (as measured by both percentage point reductions and in percentage terms) were in Western and Northern, the two regions with the most severe problem. Over that period, while Central and Eastern regions' rates fell by one-third, Northern—which had the highest rates in 2006—fell by 44 percent (leaving it with the second lowest in 2011), and Western's rates fell from 60 to 15 percent, leaving it with a prevalence that is roughly 60 percent of the rest of the country, a clear outlier.

Another notable change from 2001 to 2011 was that rural-urban differences in women's anemia rates dramatically narrowed. While urban areas made significant progress—reducing anemia by about five percentage points during this period—the progress in rural areas was more than 3-fold greater; as rural rates fell by 15 percentage points. In 2001 and 2006, rural areas had prevalence rates that were roughly 50 percent greater than those in urban areas. In 2011, the rural rate decreased to 24 percent, only 3 percentage points point greater than the urban rate of 21 percent.

A third trend was the narrowing difference in prevalence among women by household socioeconomic (wealth) status. While all socioeconomic classes—from the richest to the poorest—posted higher prevalence rates in 2006, followed by lower rates in 2011, the biggest improvements were seen in the middle quintile, followed by the richer quintile. Overall, the differences in the prevalence rates of the richest and the poorest quintile narrowed from 13 percentage points in 2001 to nine in 2011.

There were also some changes over time in the differences in women's prevalence rates by level of education. In 2001, anemia rates of the uneducated were roughly 50 percent higher than those who had more than a secondary education. In 2006, all education levels posted higher rates and differentials narrowed substantially, to just 18 percent. Then, in 2011, reductions were experienced by all education levels, but by far the biggest changes were those of the most highly educated, whose prevalence rate fell by 36 percent, and women with no education, whose prevalence rate fell by 43 percent.

Table 3.2. Prevalence of any Anemia among WRA by Selected Background Characteristics, 2001-2011

	2001	2006	2011
	percent	percent	percent
Age in 5-year groups	**		
15-19	31.0	37.0	20.0
20-24	38.0	42.0	25.0
25-29	37.0	45.0	23.0
30-34	40.0	45.0	19.0
35-39	41.0	44.0	30.0
40-44	38.0	46.0	27.0
45-49	46.0	43.0	27.0
Region	*		**
Central	35.0	40.0	26.0
Eastern	44.0	40.0	28.0
Northern	36.0	47.0	26.0
Western	36.0	44.0	15.0
Highest educational level	***		
No education	43.0	48.0	28.0
Primary	38.0	42.0	23.0
Secondary	30.0	39.0	25.0
Higher	28.0	43.0	16.0
Place of residence	***	***	
Urban	26.0	30.0	21.0

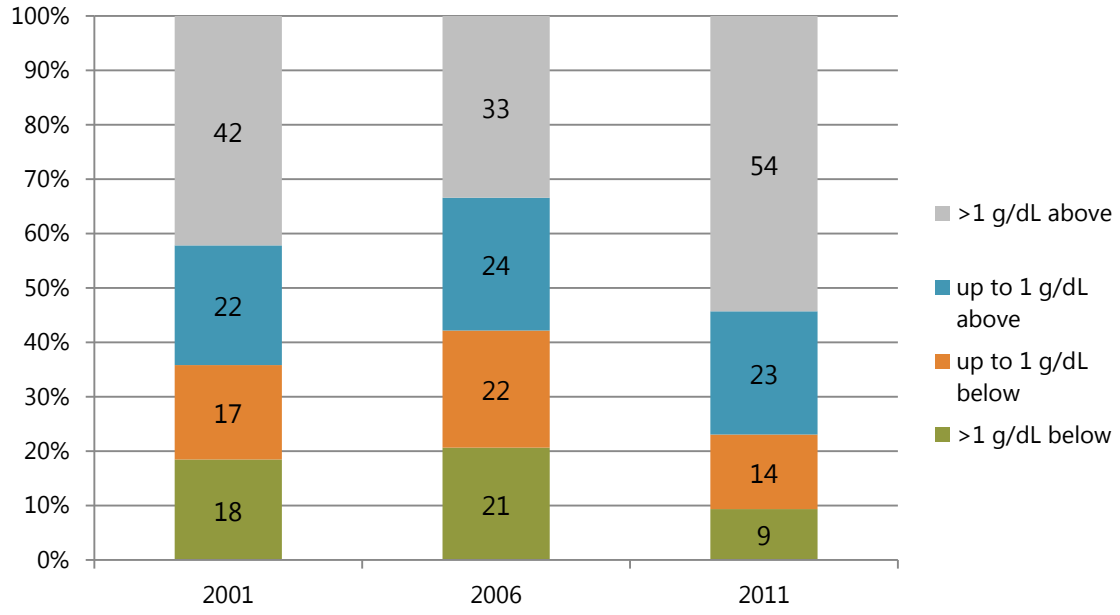
	2001	2006	2011
	percent	percent	percent
Rural	39.0	45.0	24.0
Wealth index	***	**	
Poorest	40.0	46.0	30.0
Poorer	42.0	48.0	26.0
Middle	38.0	45.0	19.0
Richer	40.0	42.0	23.0
Richest	27.0	33.0	21.0
Parity (number of children ever born)	***	***	
0	29.0	35.0	19.0
1	40.0	46.0	25.0
2	36.0	36.0	24.0
3	40.0	45.0	25.0
Currently pregnant	***	***	
No or unsure	36.0	41.0	23.0
Yes	47.0	58.0	32.0
Total	**38.0**	**43.0**	**24.0**
N	**9,118**	**3,993**	**3,599**

Design-based F test: p<0.05, ** p<0.01, *** p<=0.001 (asterisks are shown in front of the background characteristic)*

Anemia is generally measured using a binary metric (anemic/not anemic). This is a common approach, but one that may hide important information about how relatively minor changes in hemoglobin levels might affect measure and characterization of the problem of anemia. Figure 3.3 analyzes hemoglobin levels to better understand the magnitude and stability of the apparent gains that have been made in reducing anemia. In Figure 3.3, WRA are categorized by their proximity to the hemoglobin cut-off level for defining anemia (12 g/dL): not anemic (NA)—within one g/dL above cut-off and NA—more than1 g/dL above cut-off; and anemic (A) —more than one g/dL below; and A —within one g/dL below.

The proportion of the population below the anemia cut-off has fallen from 36 percent to 23 percent over the decade, and the proportion of the population that is more than one g/dL below the anemia cut-off level has fallen by 50 percent (from 18 percent to nine percent), providing further evidence that the prevalence of more severe anemia in Uganda has fallen. Among women who were anemic in 2001, approximately half were within one g/dL of the cut-off; that is, they were only slightly anemic. In 2011, 61 percent were within one g/dL of the cut-off. Thus, not only was there a reduction in the proportion of the population that was below the cut-off, but those who were below it were more likely to be closer to the cut-off; i.e., more likely to be only less anemic.

Figure 3.3. Hemoglobin Status among WRA by Proximity to Anemia Cut-off, 2001-2011



Among those who were within one g/dL of the anemia cut-off level, in 2011 there was a larger percentage that was non-anemic; 62 percent compared to 56 percent in 2001. This reveals that the proportion of women who had hemoglobin levels that are close to the anemia cut-off value were more likely to not be anemic, but were instead what we may call "anemia-vulnerable:" just above the cut-off, and their anemia status was subject to change with only a small change in their hemoglobin level.[6]

Finally, if we calculate the percent of non-anemic women who were "anemia-vulnerable," we see that percent fell from 35 percent in 2006 to 29 percent in 2011, providing further evidence of the solid gains Ugandan women have made in reducing the prevalence of anemia since 2006.

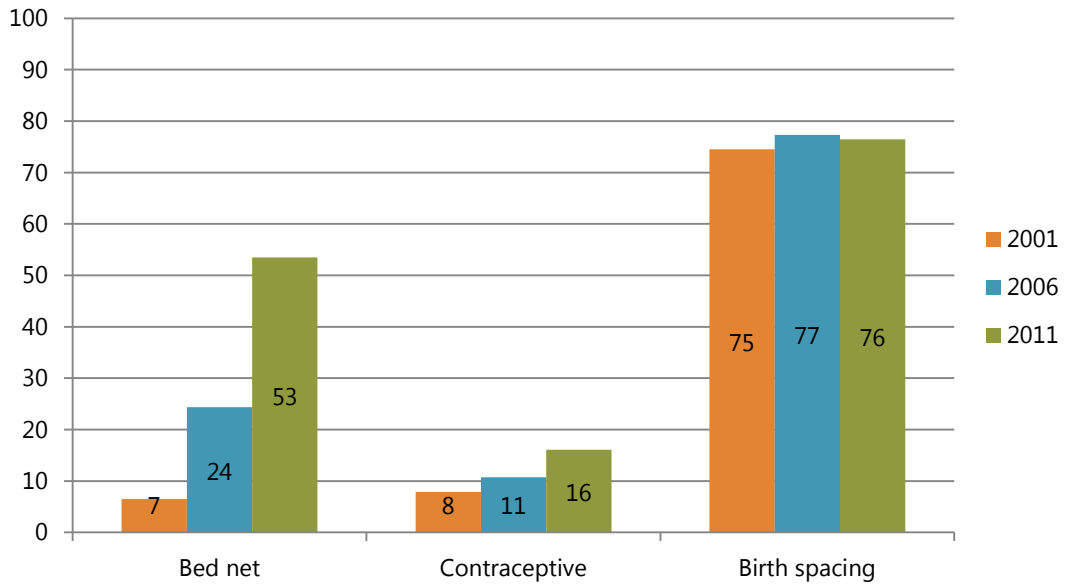
3.2 Factors That May Have Affected the Anemia Rate: Changes in Program Coverage/Participation Rates

Interventions and programs to prevent and control anemia largely focus on pregnant women, WRA, and children. When considering the potential impact of anemia-related programs on anemia prevalence, it is important to understand that health-seeking behaviors and patterns of utilization are driven by both demand- and supply-side factors. The demand for anemia-related health services cannot be considered independently from how the services are implemented. The responsiveness of the supply side will affect Ugandans' willingness and ability to use or participate in the programs. Necessary but insufficient conditions for the use of any particular anemia-related program include: 1) the service exists; 2) is culturally, economically, geographically, and socially accessible; 3) acceptable; and 4) valued by the people it is intended to serve. Therefore, data about the use of any specific anemia-related program is not simply data about which program was offered. The data we will be reviewing is the product of a combination of characteristics of both the supply (the health provider and other characteristics of the health system) and the demand side (potential consumers/clients).

[6] The concept of vulnerability is not a new one in nutrition analysis. It is well established in the analysis of the adequacy of caloric intake and food security.

Figure 3.4 depicts the use and practices of three anemia-related interventions and behaviors by WRA. As seen in the graph, bed net use increased dramatically among women between 2001 and 2011. In 2001, approximately seven percent of women 15-49 years were sleeping under a mosquito net the night before the survey. By 2011, this had increased eight-fold, to 53 percent. On the other hand, birth spacing, defined among WRA with two or more births as the percentage reporting spacing their most recent birth for 24 months or more, did not change in the last decade. Hormonal contraceptive use among WRA doubled, with 16 percent of WRA reporting use in 2011 compared to eight percent in 2001.

Figure 3.4. WRA's Participation in Various Anemia-Related Interventions (2001-2011)



How Mosquito Bed Net Ownership and Use May Have Affected the Anemia Rate

Protection with ITNs is a strongly recommended intervention for both pregnant and non-pregnant women in Uganda. In malaria-endemic countries such as Uganda, ITNs have a positive effect on pregnancy outcomes. As seen in Figure 3.5, bed net ownership increased from 40 percent in 2006 to almost 80 percent in 2011, and the proportion of women sleeping under bed nets more than doubled, from 24 percent to 53 percent. Throughout Africa in recent years, as bed net ownership has grown, a major challenge of malaria programs has been to prevent the gap between ownership and use from increasing (Rickard et al. 2011). In Uganda, this challenge is being met: the dramatic increase in bed net ownership between 2001 and 2011 was accompanied by a modest increase in the rate of bed net use by owners, from 55 percent to 67 percent.

Figure 3.5. (Left) Proportion of WRA who Owned and Slept under a Bed Net the Previous Night, 2001-2011. (Right) Among Women who Owned a Bed Net, Percentage who Slept Under It, 2001-2011.

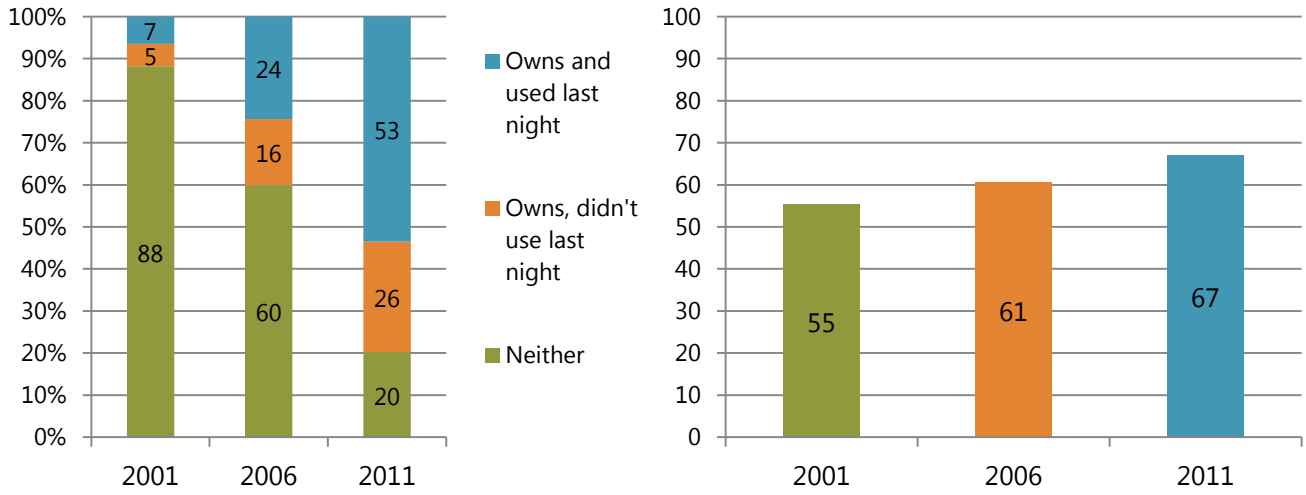


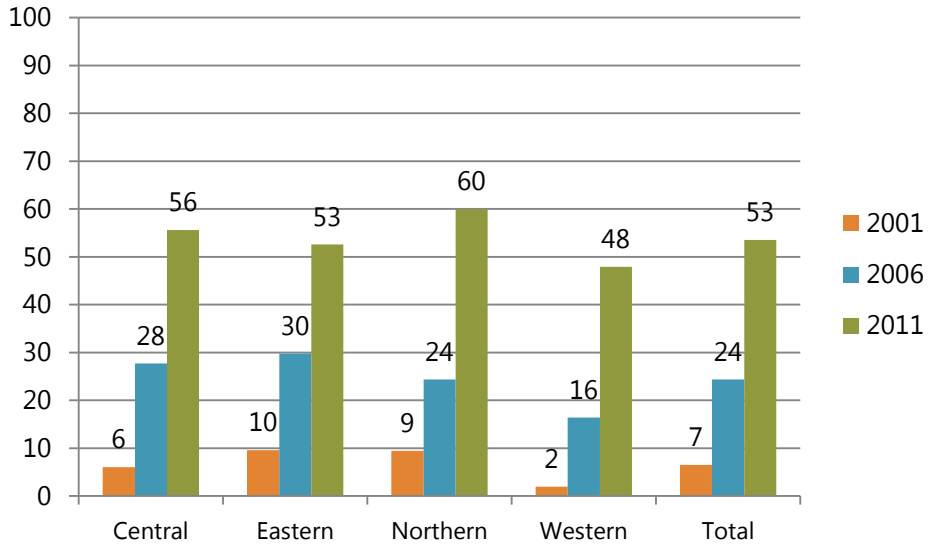
Table 3.3 disaggregates the bed net data by region, and reveals major differences among them. In 2001, the level of ownership of bed nets in the Western region—where the endemnicity of malaria is lower—was less than one-third the rate of the rest of the country. By 2006, Western had narrowed the gap but its ownership rate was still only slightly more than half the rate in the rest of the country. In the next five years, ownership rates surged in all regions of the country, and those in Western outpaced all of the other regions and came to have a rate that surpassed that of Eastern and was equal to the national average of 80 percent.

Table 3.3. Proportion of WRA Owning a Bed Net, and among Those Who Own, the Percentage Who Slept Under One the Previous Night, by Region, 2001-2011

	2001		2006		2011	
	Owned	Used	Owned	Used	Owned	Used
Central	15	41	49	56	83	67
Eastern	14	66	40	74	73	72
Northern	14	66	47	52	83	72
Western	4	46	26	62	80	60
Total	12	55	40	61	80	67

Figure 3.6 depicts ownership and bed net use by WRA the night prior to being interviewed for the UDHS by region and compares it to national estimates. The percent of all Ugandan women 15-49 years who slept under a bed net the night prior to being interviewed increased from seven percent in 2001, to 24 percent in 2006 and reached 53 percent in 2011. While Western remained the region with by far the fewest women sleeping under bed nets, it dramatically narrowed the gap with the rest of the country. From 2006 to 2011, while the percent of women sleeping under a bed net in Central, Eastern, and Northern regions grew by a factor of 1.8, in Western region it increased by more than three-fold.

Figure 3.6. Changes in the Use of Bed Nets among WRA in Uganda, 2001–2011



3.3 Antenatal Care Service Package

As mentioned in the introduction, iron requirements increase substantially during pregnancy and frequently the majority of WRA in poor countries are deficient in iron and/or anemic before they become pregnant. Even in settings where animal products are consumed routinely, it is difficult to meet the requirements for iron during pregnancy. In Uganda, the MOH recommends a package of services to be delivered to pregnant women, a subset of which includes iron supplementation, deworming drugs, and intermittent preventive treatment of malaria during pregnancy (IPT), and provision of ITNs, which are aimed at preventing and/or treating maternal anemia.[7]

Uganda has had very high ANC coverage rates (defined as having at least one visit) since the early 1990s. In 2001, antenatal care coverage was 94 percent. It edged even higher over the course of the decade, reaching 96 percent in 2011.

WHO recommends that women have at least four antenatal care visits during pregnancy, starting at no later than 20 weeks of pregnancy. As shown in Table 3.4, although antenatal care use is high in Uganda, most women sought ANC relatively late in pregnancy: the median gestation at first visit was 5.9 months in 2001 and decreased to 5.1 months in 2011. Similarly, even though the number of ANC visits rose between 2001 and 2011, only 48 percent of the women had attended the WHO-recommended four ANC visits.

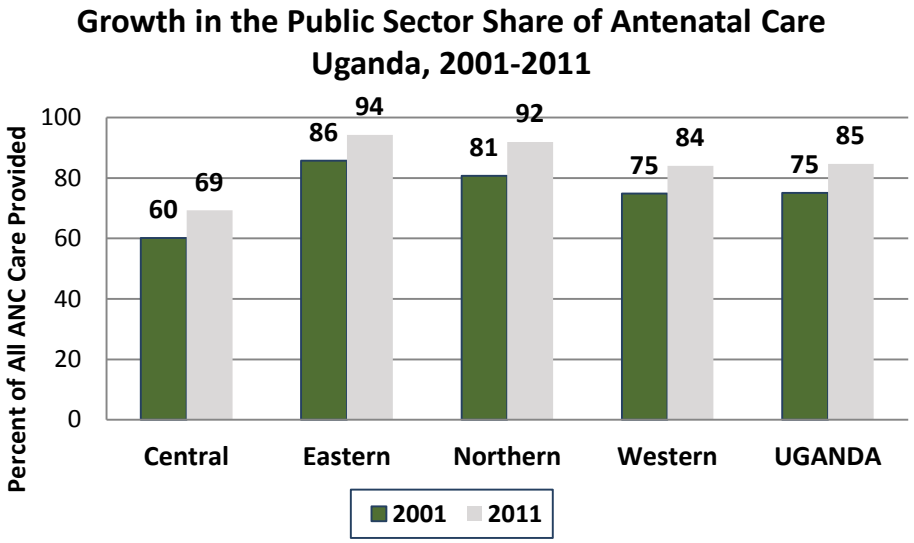
[7] Use of ITNs is also recommended for pregnant women, and the NMCP's Strategic Plan calls for ITNs to be distributed during antenatal care clinic visits. The DHS, however, does not collect information about ITN use specifically during pregnancy: it asks only about bed net use the night prior to the survey.

Table 3.4. Trends in ANC Use in Uganda 2001-2011

Number and Timing of ANC Visits in Uganda			
ANC Characteristic	**2000/01**	**2006**	**2011**
a. Number of ANC Visits			
0	6%	5%	4%
1	8%	6%	4%
2-3	42%	42%	42%
4+	42%	47%	48%
Missing/Don't Know	2%	0%	2%
b. No. of Months Pregnant at First Visit			
No ANC	6%	5%	4%
<4 months	14%	17%	21%
4-5 months	35%	41%	44%
6-7 months	38%	33%	28%
8+ mnths	7%	4%	3%
Don't know/Missing	0%	0%	0%
c. Median Months Pregnant at First Visit			
(Denominator = Those with ANC)	5.9	5.5	5.1
ANC Characteristics\Combos-Women Kids breakdowns.xlsx			

Figure 3.7 shows that women are more like likely to seek ANC coverage in the public than in the private sector in Uganda. From 2001 to 2011, the share of ANC coverage provided by the public sector grew from 75 to 85 percent nationally. While the importance of the public sector as a source of ANC varies by region, the share of the public sector in ANC has grown in all regions of the country, and in 2011 averaged 85 percent nationwide. Given Uganda's 3.3 percent population growth rate (Index Mundi 2013), and in light of its already high and stable ANC coverage and its high and steady average number of ANC visits per pregnancy, this trend means there has been a substantial increase in the number of ANC visits provided by the public sector over the decade. This trend suggests that, though ANC is a particularly powerful platform for reaching the vast majority of pregnant Ugandans, women access the platform late and miss a significant opportunity to expand the coverage of several anemia-related services that are part of the ANC integrated service package.

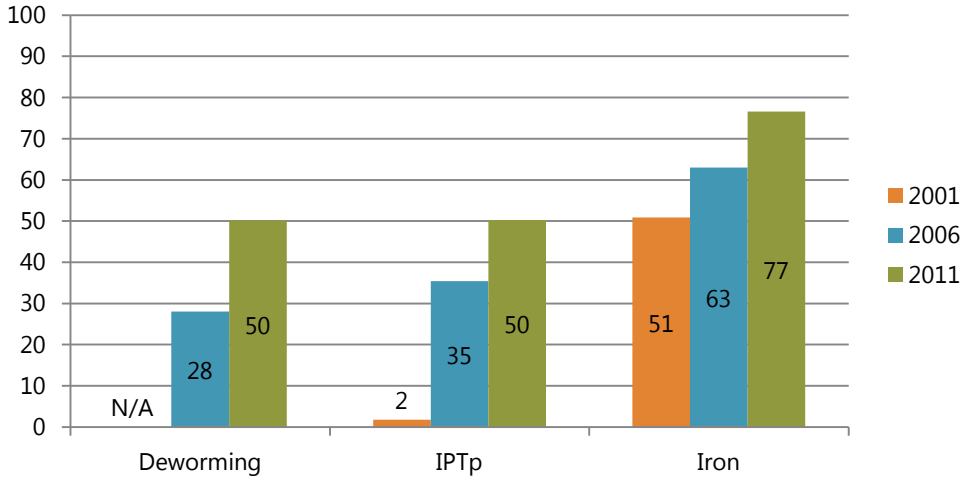
Figure 3.7. Proportion of Women who Used ANC Services from the Public Sector 2001–2011



The next few graphs present the use of the recommended services in Uganda's ANC package over the decade. They also examine discernible trends in how consistently the individual anemia-related services included in the ANC package were provided.

As shown in Figure 3.8, among women who had a child in the past five years, the percentage of women receiving any iron supplementation during pregnancy increased from 51 percent in 2001 to 77 percent in 2011. Similarly, the percent of women receiving any dose of IPT during pregnancy rose from 2 to 50 percent over the same time period. Research has shown that IPT of malaria with sulfadoxine pyrimethane (SP) can reduce maternal anemia and reduce low birthweight among children (Falade et al, 2007; Verhoeff et al, 1998). Although the 2001 survey did not ask about deworming drugs, between 2006 and 2011 the proportion of women who received at least one deworming medication during pregnancy almost doubled, from 28 to 50 percent. It is interesting to note that IFA supplementation is the program that had the smallest increases between 2006 and 2011, whether measured in percentage terms or in percentage point increases.[8]

Figure 3.8. Use of Select Anemia-Related Services during ANC among Women who had a Birth in the Past five Years



[8] In part this is due to its having a ceiling effect—with less room for improvement due to its already high level—compared to the other two services.

Coverage of ANC Services by Region

Figure 3.9 shows the regional variation in the percentage of women with a child born in the past five years who reported receiving and taking at least one IFA tablet over 2001-2011. In all three survey periods, Western region lagged behind the other three regions. However, Western also had the greatest improvements in coverage rates over the 2006–2011 period, increasing proportionally and in terms of percentage point (from 30 to 67 percent). Most of the improvement in both the Western and Northern regions was made between 2006 and 2011.

Figure 3.9. Among Women with a Child Born in the Past five Years, Percentage who Reported Taking Iron Supplements During Pregnancy, by Region

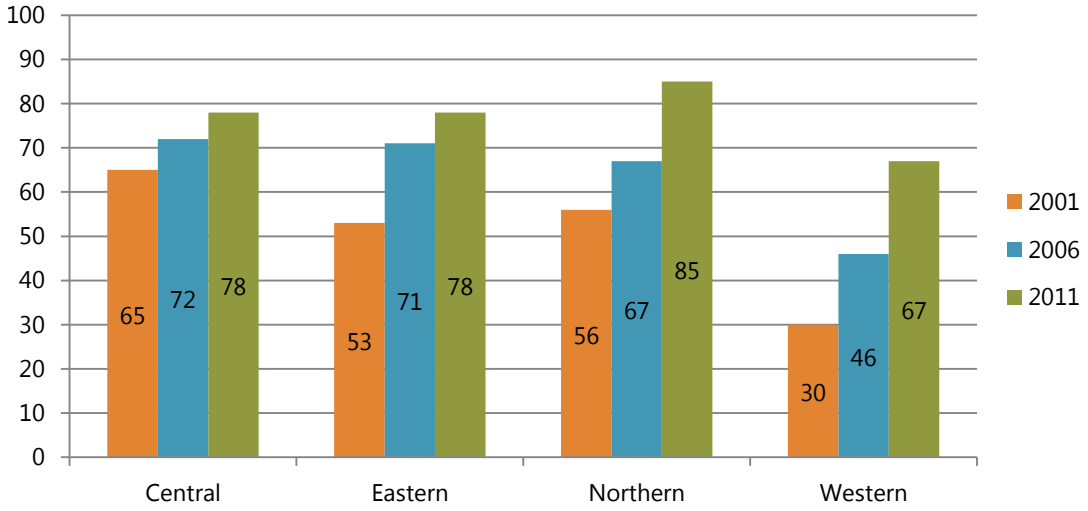
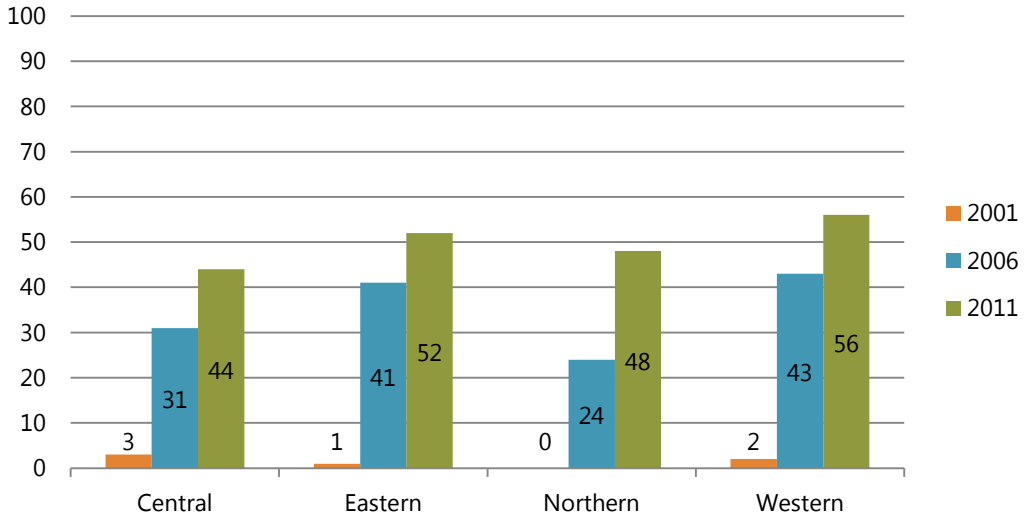


Figure 3.10 shows regional variations among women who gave birth in the past five years taking at least one dose of SP during their last pregnancy. WHO recommends that women who live in countries with stable malaria transmission be given at least two doses of SP, at the first and second ANC visit after quickening (the first noted movement of the fetus) is observed. In Uganda, a steady increase in at least one dose of IPTp was observed between 2001 and 2011 across all regions, with the greatest increase seen in the Eastern and Western regions. However, second dose with IPTp remains low, with less than seven percent of women consuming it (not shown).

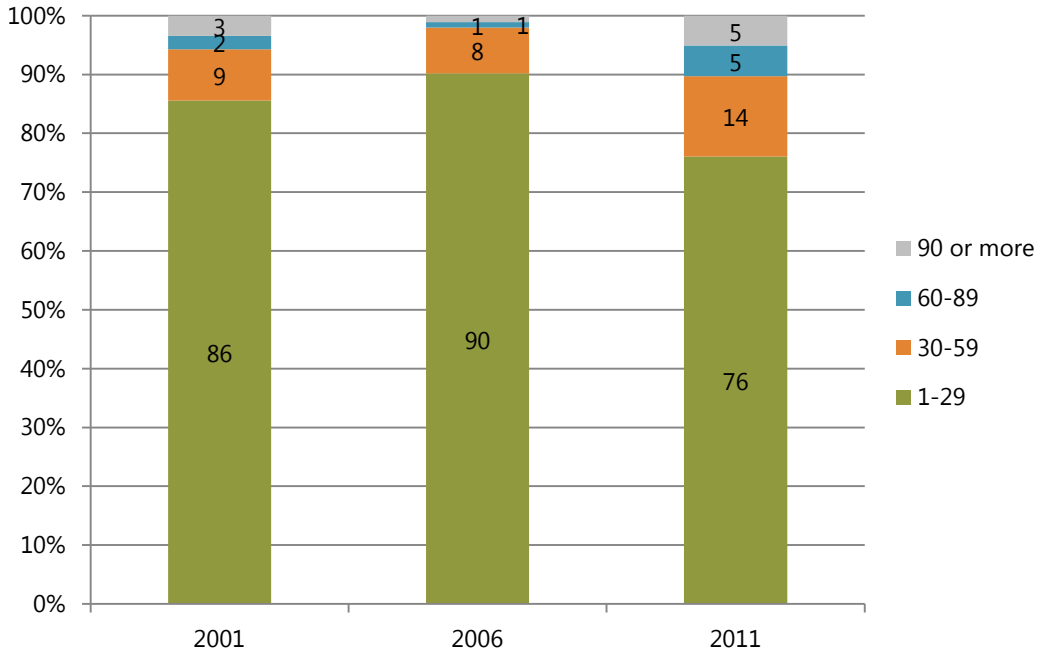
Figure 3.10. Among Women with a Child Born in the Past five Years, Percentage who reported Taking at Least One Dose of IPTp, by Region



Distribution and Consumption of Iron–Folic Acid Tablets through Antenatal Care

Although the proportion of women receiving any iron supplementation improved over the past decade, progress in the number of IFA tablets distributed has been slow and the average number of tablets received and consumed by Ugandan women during their last pregnancy in the past five years remains low; less than one percent reported consuming the Uganda National Anemia Policy's target of 180 IFA tablets.[9] As Figure 3.11 shows, among women who received any supplementation, the proportion that took 30 days' worth of pills (just one-sixth of the target) or more decreased between 2001 and 2006 (14 to 10 percent), before increasing in 2011 when it reached 24 percent.

Figure 3.11. Among Women who reported any Iron Supplementation during Pregnancy, Distribution of Numbers of Pills Taken, 2001–2011



Among women who had at least one ANC visit, 86 percent ingested at most one-quarter (45) of the WHO-recommended number of IFA tablets. Even among those who received some tablets and had four or more visits, 86 percent ingested at most one-quarter of the WHO-recommended number.

Figure 3.12 analyzes 2011 UDHS data to provide a rapid assessment of how well IFA is distributed through the ANC delivery system. The analysis is based on questions that were asked of women who were in a permanent union and had been pregnant in the five years prior to being interviewed. Figure 3.12 shows the number and percent of women who obtained ANC, and who subsequently received and consumed IFA tablets. The figure tracks women's entry into ANC and identifies four critical points at which the system might falter (highlighted in green).[10]

As mentioned, many aspects of the supply side of the program—including both the adequacy of supplies and the practices of ANC providers—should be considered when assessing how well the ANC program distributes IFA. For

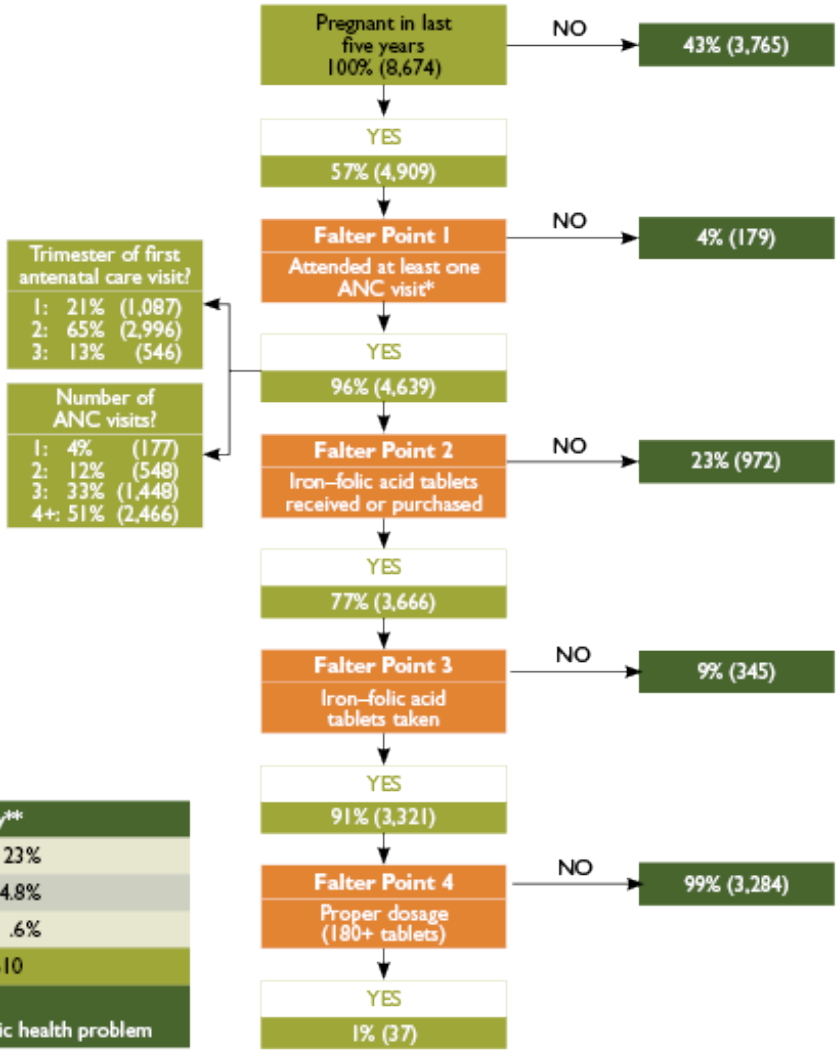
[9] Both the World Health Organization (WHO) and Uganda's National Anemia Policy recommend that all pregnant women receive a standard dose of 60mg iron + 400 µg folic acid for at least six months; a total of ideal 180 IFA tablets (WHO 2012; MOH 2002).

[10] Although the UDHS asked about IFA tablets or capsules, this brief refers to all of them as "tablets."

a pregnant woman with one or more ANC visits to consume the WHO-recommended ideal number of IFA tablets, she must be given and ingest a minimum of 90-180 IFA tablets. In addition, demand-side considerations such as whether or not women seek ANC, and the timing and number of visits are also critical. These considerations also include the extent to which women are aware of the significance of anemia and IFA, and whether they ask for IFA tablets and comply with the regimen.

The UDHS did not collect information on the number of IFA tablets received by women. In the case of Falter Point 4, this lack of data creates ambiguities that make it challenging to disentangle whether shortcomings of the system are attributable to supply- or demand-side factors. Despite this limitation, the data in Figure 3.12 still enable prioritizing the falter points for more in-depth analysis, which is an essential next step to improving understanding of the causes of falter points and building an evidence-based approach to systematically improving the program.

Figure 3.12. Analysis of Falter Points Related to Distribution and Consumption of IFA through Uganda's ANC Program, Women of Reproductive Age (15–49y) n=8,674



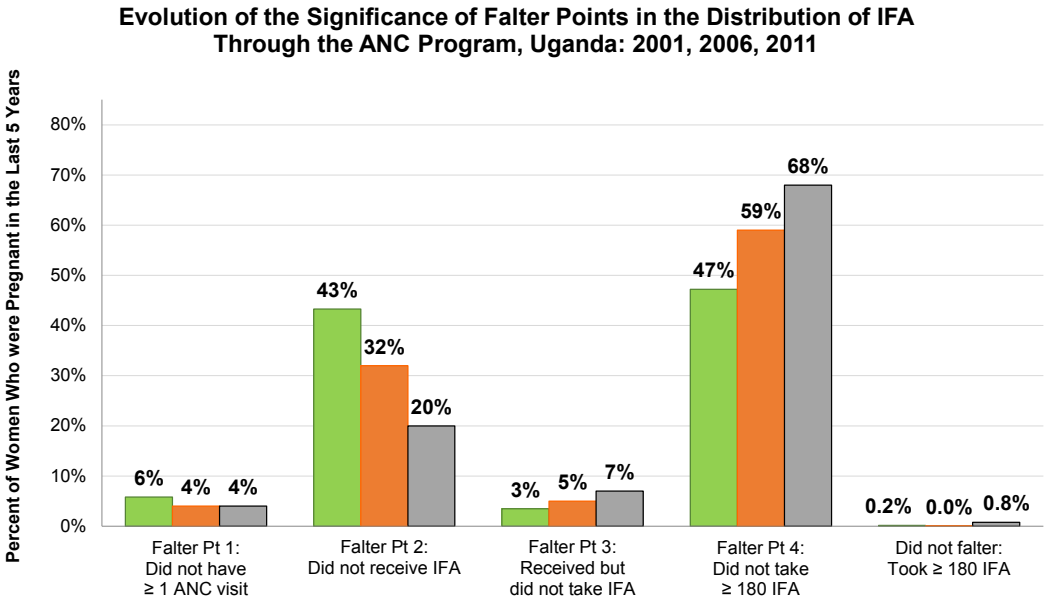
Anemia Prevalence by Severity**	
PW, by anemia[a]	23%
NPW, severe anemia[b]	4.8%
PW, severe anemia[c]	.6%
No. of women	2,610
WHO categorization: Anemia is a MODERATE public health problem	

Main conclusions: Uganda's high ANC coverage makes it a strong vehicle for IFA distribution. Still, among women who were pregnant in the last 5 years, had at least 1 ANC visit, and took at least 1 IFA tablet, only 1% received and took the WHO-recommended 180 IFA tablets. The most important shortcoming is Falter Point 4, but Falter Point 2 is also significant. Work should begin as soon as possible on Falter Point 2. Supply and demand are both likely constraints.

Percentages are calculated from weighted data and may vary slightly from the unweighted observations-based calculations. 1 percent of women who were pregnant in the last 5 years did not have any ANC visits but received or purchased IFA from another source.
* Percentage of women 15–49 years based on Hemoglobin levels, Hb (g/dL)
[a]NPW 10.0<Hg<11.9 + PW 10≤Hg<10.9 [b]7.0≤Hg<9.9 [c]Hg<7.0
Non-responses, no data (NR/ND) were recoded to "No" for ""At least 1 ANC visit?" "IFA tablets received?" and "IFA tablets taken?" and to zero for "Number of tablets taken?".
Anemia prevalence data are provided as a reference point, signaling the general order of magnitude of the anemia public health problem. The ANC utilization data is based on self-reported data of women 15–49 years in permanent unions and pertains to their last pregnancy in the last 5 years prior to the DHS survey.
SOURCE: Calculations and anemia levels from the DHS database (2011).

Figure 3.13 shows the relative importance of each of the obstacles among all women— including those who did not receive ANC during their pregnancy—to ingesting the minimum appropriate number of IFA tablets. As evident in Figure 3.13, Falter Points 2 and 4 have been the most important throughout the past decade but their relative importance is changing. Whereas at the beginning of the decade they were of roughly equal significance, by the end of the decade Falter Point 4 was unequivocally the most important, accounting for why more than two-thirds of women who were pregnant in the previous five years had not received or ingested the WHO-recommended number of IFA tablets.

Figure 3.13. Significance of the Falter Points in the Distribution of IFA through the ANC Program



Total Number of Antenatal Interventions

To better understand the specific combinations of anemia-related services provided as part of the antenatal care package, a woman-specific analysis of the UDHS was conducted. Table 3.5 shows that the total number of anemia-related interventions received by pregnant women improved between 2006 and 2011 (2001 is not included because women were not asked whether they received deworming medication).

Table 3.5. Among Women who Gave Birth in the Past five Years, Total Number of Antenatal Interventions Received, 2006 and 2011

Number	Specific program combination	2006	2011
0	None	22.15	11.87
1	Deworming only	3.54	3.66
	Antimalarial only	7.79	4.65
	IFA only	29.29	17.75
	1 program	40.62	26.06
2	Deworming and antimalarial only	3.49	3.09
	Deworming & IFA only	9.85	16.31
	Antimalarial & IFA only	12.66	15.7
	Any 2 programs	26	35.1
3	All 3 ANC programs	11.24	26.98

4.0 Results: Children 6–59 Months

Anemia resulting from severe iron deficiency, iron losses due to malaria, and other infections and micronutrient deficiencies are among the most widespread public health problems in infants and young children in the developing world. This section presents the findings of changes in anemia prevalence and program use among children 6–59m in Uganda. As indicated in the methods section, the analysis for children was disaggregated into two groups: 6–23 months, and 24–59 months of age. We conducted separate analyses of these two groups because 6–23m: 1) are known to be particularly susceptible to anemia (Soares, Magalhães and Clements 2011); 2) have different nutritional recommendations; and 3) preliminary analysis empirically demonstrated the different prevalence rates of these two groups, which motivated us to explore the nature of these differences in an attempt to better understand their dynamics and causes.

4.1 Prevalence of Anemia by Background Characteristics among Children 6–59 Months

As shown in Figure 4.1, anemia prevalence for both age groups declined by over 20 percentage points between 2001 and 2011. Younger children are known to be more vulnerable to anemia, and this is evident in the UDHS data. From 2001 to 2006, the prevalence of anemia edged upward from 85 to 87 percent among 6–23m, before falling 24 percent percentage points to 63 percent in 2011. The prevalence among 24–59m followed a similar trend. In part, the differences in these rates—with the youngest children being 50 percent more likely to have anemia—may reflect the higher iron requirements during the first two years of life. The prevalence of anemia is highest among 6–23m in Uganda.

Figure 4.1. Prevalence among Children 6–23 Months (Left) and among Children 24–59 Months (Right)

Table 4.1 reports prevalence of child (6–59m) anemia by background characteristics. As shown in the table, there has been a widespread decline in anemia among children of all age groups. The rates have decreased across both sexes, in children of mothers of all educational levels, in children at all levels of wealth, in urban and rural areas, and in all regions.

Table 4.1. Prevalence of Any Anemia among Children 6–23 Months and 24–59 Months, by Selected Background Characteristics, 2001–2011[11]

	Children 6–23 months			Children 24–59 months		
	2001	2006	2011	2001	2006	2011
Total	**84.6**	**87.4**	**62.9**	**63.4**	**64.9**	**42.4**
Age groups	*	*				
6-9 months	89.33	93.0	69.4	NA	NA	NA
9-23 months	83.6	86.3	61.6	NA	NA	NA
Sex of child		*			*	
Male	85.6	90.9	65.3	63.5	67.6	42.8
Female	83.5	84.1	60.8	63.2	62.2	42.0
Region	***	***	***	***	***	***
Central	85.2	91.6	67.6	60.4	60.5	41.9
Eastern	88.1	93.6	72.7	68.4	73.3	55.0
Northern	90.3	89.0	71.9	70.9	71.5	43.2
Western	75.7	76.9	39.2	55.3	55.5	26.4
Highest educational level of mother				***	**	
No education	86.2	85.5	60.2	67.8	70.6	44.9
Primary	84.5	87.5	64.6	63.9	65.3	43.9
Secondary	82.8	93.1	59.6	54.0	54.2	36.7
Higher	74.3	76.6	58.2	24.3	48.7	33.2
Type of place of residence	*		*	***	***	***
Urban	79.4	82.1	52.4	46.1	47.4	30.4
Rural	85.1	87.9	64.4	65.1	67.1	44.2
Wealth index			*	***	***	***
Poorest	84.5	91.6	70.9	69.2	74.8	55.7
Poorer	88.6	85.2	67.2	67.4	68.2	43.9
Middle	84.7	85.0	64.1	62.6	65.9	45.0
Richer	83.0	89.7	59.5	62.9	64.3	30.8
Richest	79.7	86.2	48.4	50.8	46.9	31.3

[11] * $p<0.05$, ** $p<0.01$, *** $p<=0.001$ (asterisks are shown in front of the background characteristic)
NA: Not applicable

In 2011, the prevalence of anemia in both children's age groups varied significantly by region, place of residence, and household wealth quintile. Whereas from 2006–2011 there was a narrowing of the differences in women's anemia prevalence rates by these characteristics, among children the trends were more mixed and the gap grew for some characteristics but not others. Although Western children experienced the largest percentage point and percentage reductions in anemia prevalence from 2006 to 2011, they were already the lowest in 2006.

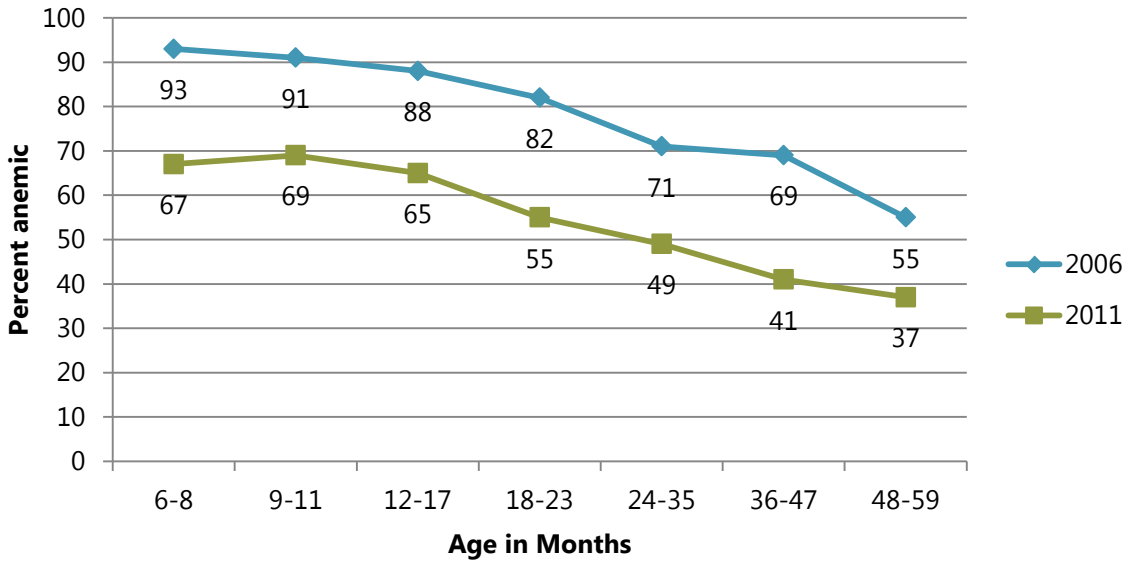
Throughout the decade, differences in anemia stratified by children's mothers' education level were much greater among 24–59ms than among younger children. Among the 6–23ms, the maximum difference in rates was about 15 percentage points and changed little between 2001 and 2011. In contrast, among older children the differential approached three-fold in 2001, and declined considerably over the course of the decade. By 2011, the prevalence of anemia among 24–59m with uneducated mothers decreased from 68 percent to 45 percent, while that of mothers with secondary education increased seven percentage points from 24 to 33 percent. These trends are difficult to explain.

These more mixed results by children's age groups and the relatively greater changes in the anemia prevalence rates of 24–59m vis-à-vis those of 6–23m are also found by place of residence, although the reduction in urban-rural differences in anemia rates seen in 6–23m were not seen in 24–59 m.

When looking at trends by economic status, the relative magnitude of the reduction in anemia among 6–23m of the wealthiest household quintile and among 24–59m of the wealthiest two quintiles was larger than among poorer quintiles in 2011 (31 versus 14 percent).

Comparing child anemia rates in 2006 and 2011 by distinct age groupings, as in Figure 4.2 below, one sees that the very youngest children for whom we have data—those 6–8 and 9–11 months old—have the highest prevalence rates. Rates of progressively older children fall steadily thereafter, reaching their lowest point among the 4-year-olds, the oldest of this group.

Figure 4.2. Prevalence of Anemia by Age in Months

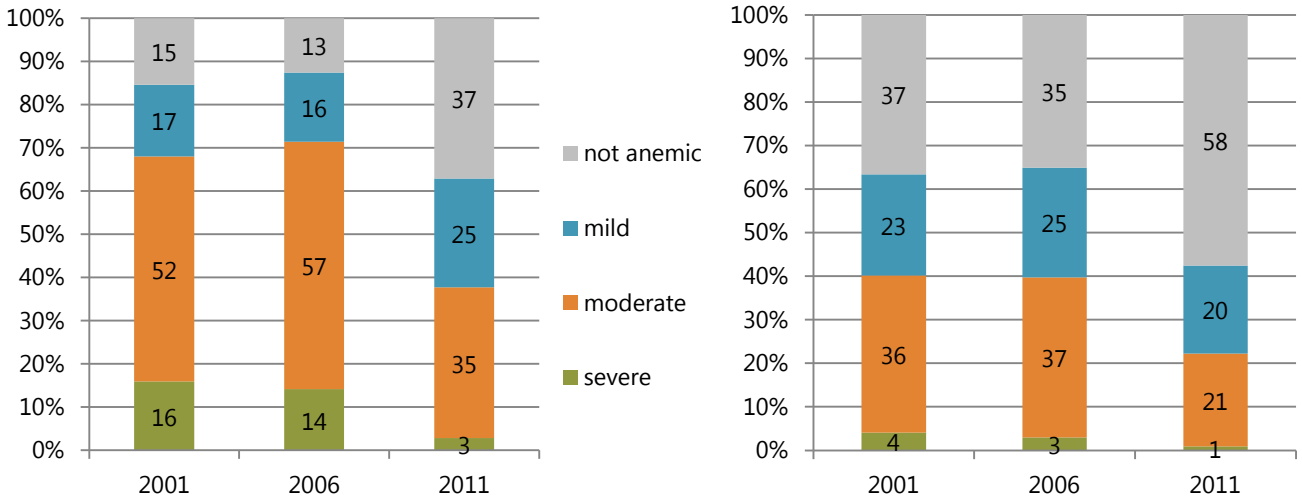


Anemia Severity

Over the 2001-2011 period, anemia was not only more prevalent among the 6–23ms compared to the 24–59ms; it was also more severe. Throughout the past decade, an (unweighted) average of 60 percent of all anemia among

6–23ms was moderate or severe, compared to 33 percent among 24–59ms. While 24–59ms experienced larger declines in prevalence over the past decade, the younger children experienced larger reductions in severe anemia. In contrast with the trends among women—who have experienced declines in primarily mild anemia—the greatest reductions in anemia among children (in percentage point reductions and in percentage changes) has been in moderate and severe anemia. As seen in Figure 4.3, among 6–23m, in both 2001 and 2006, those with moderate anemia were the largest of the four groups depicted. By 2011, severe anemia had been reduced to less than one-fifth its 2001 level and children with no anemia constituted the largest group. Similarly, anemia among 24–59m declined 42 percent between 2001 and 2011, and severe anemia had been reduced to one-quarter of its 2001 level.

Figure 4.3. Among Children 6–23 Months (Left) and 24–59 Months (right), Prevalence of Anemia by Severity Level, 2001–2011



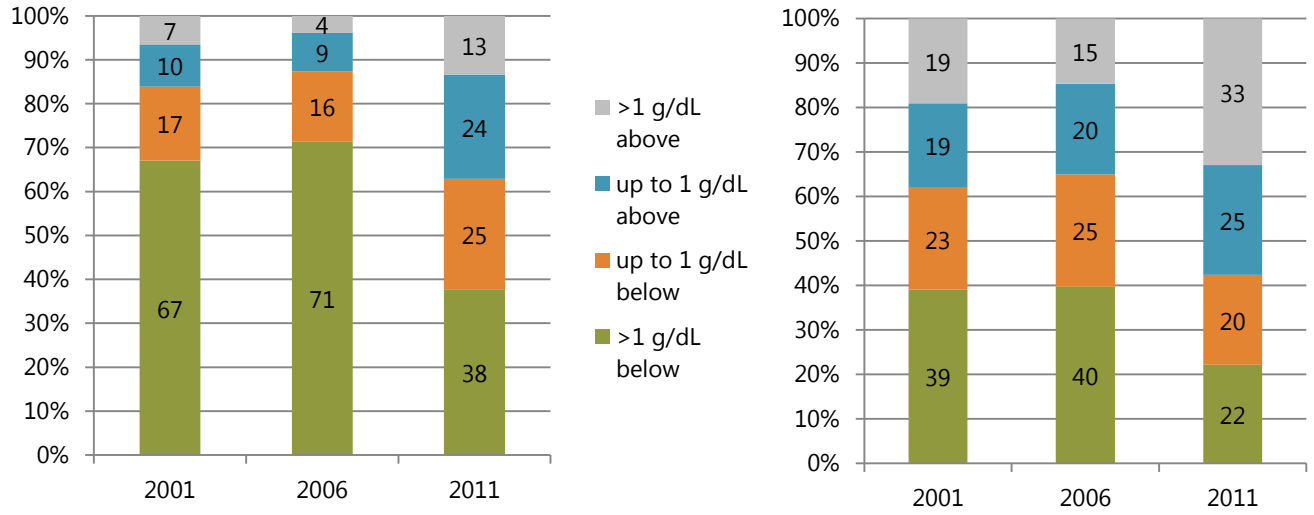
4.2 Anemia Vulnerability

To better understand children's anemia dynamics, we introduce an alternative, more sensitive measure of anemia that categorizes children by their proximity to the hemoglobin cut-off level for defining anemia (11 g/dL): not anemic (NA)—within one g/dL above cut-off, and NA—more than1 g/dL above cut-off; and anemic (A)—more than one g/dL below, and (A)—within one g/dL below. Figure 4.4 presents the distribution of 6–23m and 24–59m for 2001, 2006, and 2011.

The proportion of the population below the anemia cut-off has fallen from 84 percent to 63 percent for 6–23ms and from 62 percent to 42 percent among 24–59ms, over the decade. During that time, the proportion of children that is more than one g/dL below the anemia cut-off level has fallen by 43 percent (from 67 to 38 percent), providing further evidence that the prevalence of more severe anemia in Ugandan children has fallen. Among those who were anemic in 2001, 20 percent were within one g/dL of the cut-off; that is, they were only slightly anemic. In 2006, 18 percent were within one g/dL of the cut-off, and in 2011 this percentage rose to 40 percent. Thus, while there was an increase in the proportion of the 6–23m who were not anemic, there was also an increase in the proportion of those who were anemia-vulnerable.

Among 6–23ms considered "anemia-vulnerable," the non-anemic proportion increased from 37 percent in 2001 to 49 percent in 2011. Thus, while there has been significant progress in reducing the anemia prevalence rate among 6–23ms, there has been an even more substantial increase in the hemoglobin levels of this portion of the population, which reliance on the binary anemia prevalence indicator masks.

Figure 4.4. Hemoglobin Status among Children 6–23 Months (Left) and 24–59 Months (Right), 2001–2011



Turning to the 24–59ms, we see that the proportion of these children who were within one g/dL of the anemia cut-off level was much larger than the proportion of 6–23ms in 2001(42 percent compared to 27 percent, respectively). Ten years later in 2011, the relative significance of the percentage of persons close to the anemia cut-off level had changed dramatically for these groups. Among the youngest children, it had grown from 27 to 49 percent (an increase of 56 percent), while among the older children it had grown from 42 to 45 percent, an increase of just seven percent. This suggests a sort of "catching-up" of hemoglobin levels among 6–23ms and their older counterparts.

Among 24–59ms within one g/dL of the anemia cut-off level in 2001, a larger percentage was anemic; 45 percent compared to 56 percent in 2011. This reveals that—just as was found among the 6–23ms—a growing share of the proportion of 24–59m who had hemoglobin levels that were close to the anemia cut-off value in 2011 were more likely to be "anemia-vulnerable" than they were in 2001.

In sum, when we introduce a more discerning metric—hemoglobin levels— and focus the analysis on a small range (plus or minus one g/dL above or below the 11 g/dL anemia cut-off level), we find that—

- the proportion of all children that were within one g/dL of the anemia cut-off level of hemoglobin increased from one-third to nearly one-half
- the proportion of the population that is not anemic, but is "anemia-vulnerable" increased from nine percent to 24 percent among 6–23m olds and from 20 percent to 25 percent among 24–59ms: the anemia status of one-quarter of all 6–59ms is subject to change with relatively small changes in their hemoglobin level (<1 g/dL).

With continued progress, the number and percentage of the population with hemoglobin levels that qualify them as not anemic but whose levels are very close to the cut-off value is likely to remain relatively constant. To understand the process by which the anemia status of a population improves, it is necessary to consider what is happening to the entire population.

4.3 Trends in Relevant Behaviors

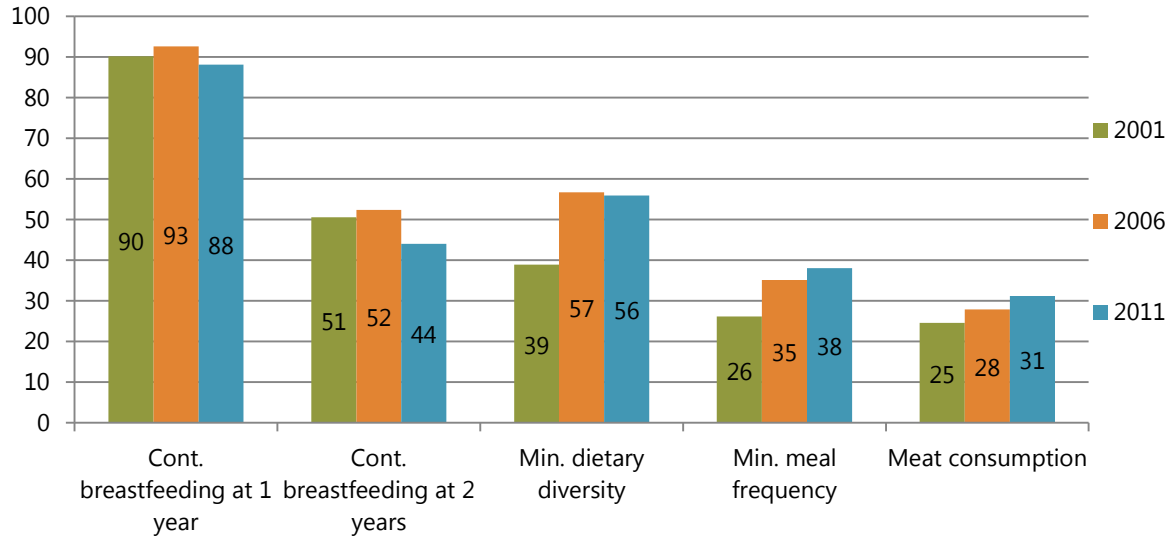
Feeding Practices and Dietary Patterns

A common cause of inadequate child growth and anemia is poor feeding practices, particularly starting after six months of age, when children need appropriate food to complement breastmilk. Specific interventions such as promoting micronutrient powders and increasing dietary diversity are important components of the necessary intervention to improve overall the timing and quality of complementary feeding (UNICEF-CDC and HF-TAG 2013). Figure 4.5 summarizes trends in five selected indicators of feeding practices and dietary patterns of 6–23ms for which the DHS collects information: 1) continued breastfeeding at one year; 2) continued breastfeeding at two years; 3) minimum dietary diversity;[12]4) minimum meal frequency within the past 24 hours (as defined by WHO); and 5) and consumption of meats[13] (which are rich in iron) in the past 24 hours.

For all survey years, continued breastfeeding at one year remained high and declined only marginally from 90 percent to 88 percent between 2001 and 2011. Continued breastfeeding at two years, on the other hand, decreased by more than seven percentage points between 2001 and 2011, underscoring concern about the breastfeeding practices of young children.

Other dietary measure, such as minimum meal frequency and the proportion of children consuming meat, improved between 2001 and 2011. The minimum dietary diversity increased from 39 percent in 2001 to 56 percent in 2011, an improvement of 17 percentage points. Minimum meal frequency and the proportion of 6–23ms who consumed meat also increased marginally between 2001 and 2011. Both of these measures, however, have been consistently low and their rates of increase minimal in the last decade.

Figure 4.5. Changes in Feeding Practices in Uganda among Children 6–23 Months, 2001–2011



[12] *Dietary diversity refers to the child receiving 4+ of the following food groups during the previous 24 hours:*, roots and tubers; legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, fish, poultry and liver/organ meats); eggs; vitamin A-rich fruits and vegetables; other fruits and vegetables.

[13] 2001 figures include eggs, which are not as high in iron as meat. As an estimate of the possible inflation of 2001 numbers, the percentage of children who ate eggs (but no meat) in 2006 were 3.6 percent for 6–23ms and 2.2 percent for 24-59ms. Meat consumption was not asked about in 2001; however, the DHS did ask if children consumed eggs, fish, or poultry.

Table 4.2 presents regional information on the percentage of 6–23m children who consumed meat in the past 24 hours.[14] From 2001 to 2006, the percentage grew nationwide and in three of the four regions, falling only in Northern.

Figure 4.5 and Table 4.2 suggest that changes in the feeding behaviors of young children have improved marginally. Changing feeding practices of children, especially of the 6–23ms, were, at best, a minimal contributor to the reductions in anemia that children experienced between 2006 and 2011.

Table 4.2. Percentage of Children Who Consumed Meat, Poultry, Fish, and/or Shellfish in Past 24 Hours, 2001–2011

	Children 6–23 months		
	2001	2006	2011
Central	28.2	35.8	44.1
Eastern	33.9	35.7	36.5
Northern	27.9	18.7	26.8
Western	8.7	20.7	15.8
Total	**24.6**	**27.9**	**31.2**

Program Participation Rates

Figures 4.6 and 4.7 show trends in the participation of children in three anemia-related programs (survey respondents were not asked about deworming in the 2001 survey). The coverage of all three of the programs has grown each year, except vitamin A coverage among 6–23m in 2011. By far, the most dynamic program has been bed nets, which had the highest growth rates of any program in any year and in the most recent survey, 2011, was the program with the highest coverage rate.

The Roll-Back Malaria (RBM) program has set a target of 80 percent of children sleeping under a bed net by 2010. While this goal is ambitious, Figures 4.6 and 4.7 show that Uganda is moving steadily toward that target. It is also interesting to note that a slightly higher proportion of 6–23ms slept under a bed net as than did 24–59ms in 2006 and 2011.

The next-highest rate of program coverage was that of vitamin A supplementation. While the rate among the older children has increased, its pace has lagged behind that of the younger age groups in 2006 and 2011. On the other hand, when vitamin A coverage rates fell among the 6–23ms between 2006 and 2011, they continued to increase among 24–59ms. Among the older children, the rates of coverage of deworming and vitamin A have varied by only one or two percentage points and have moved in tandem. The deworming rates have been relatively lower among the younger group, reflecting the fact that the program is limited to children 12 months of age and older.

[14] WHO has not developed recommendations for the "minimum acceptable diet" for children older than 24 months.

Figure 4.6. Among Children 6–23 months,[15] Percentage Participating in Anemia-Relevant Programs, 2001–2011

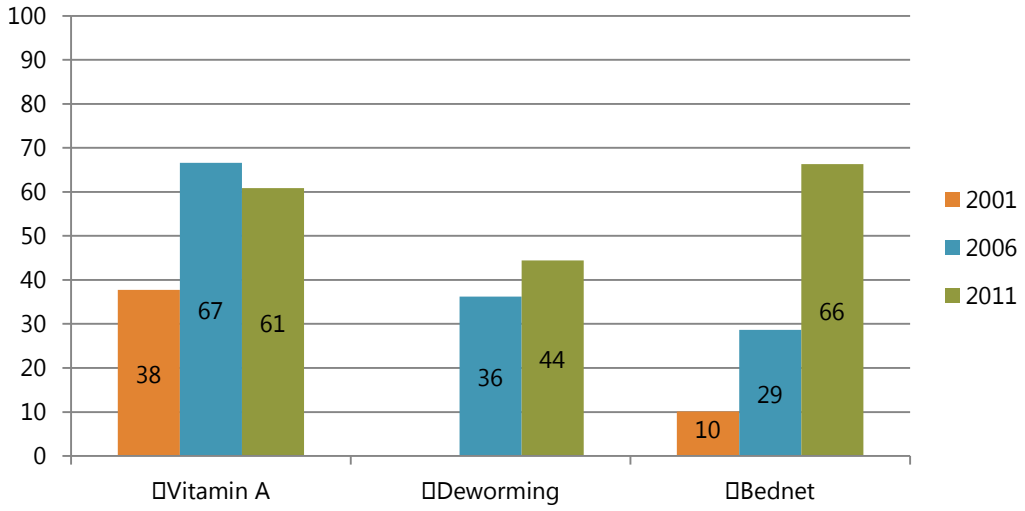
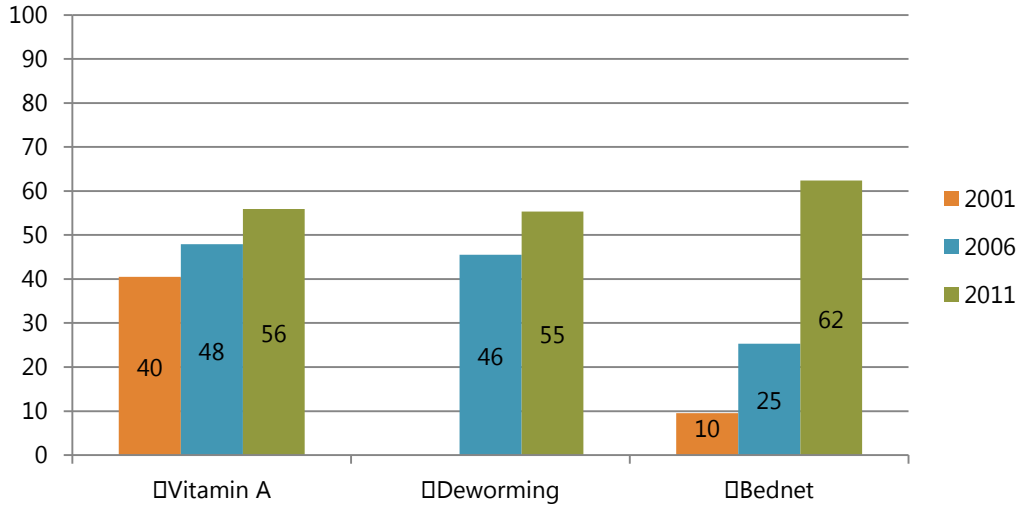


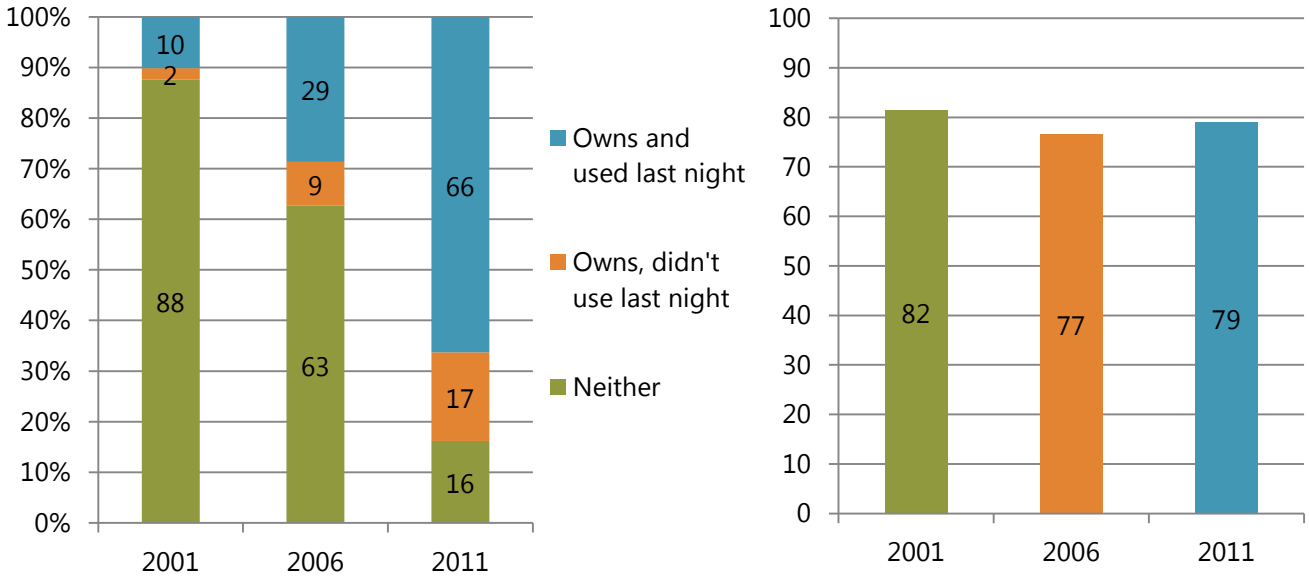
Figure 4.7. Among Children 24–59 Months, Prevalence of Select Anemia-Related Programs, 2001–2011



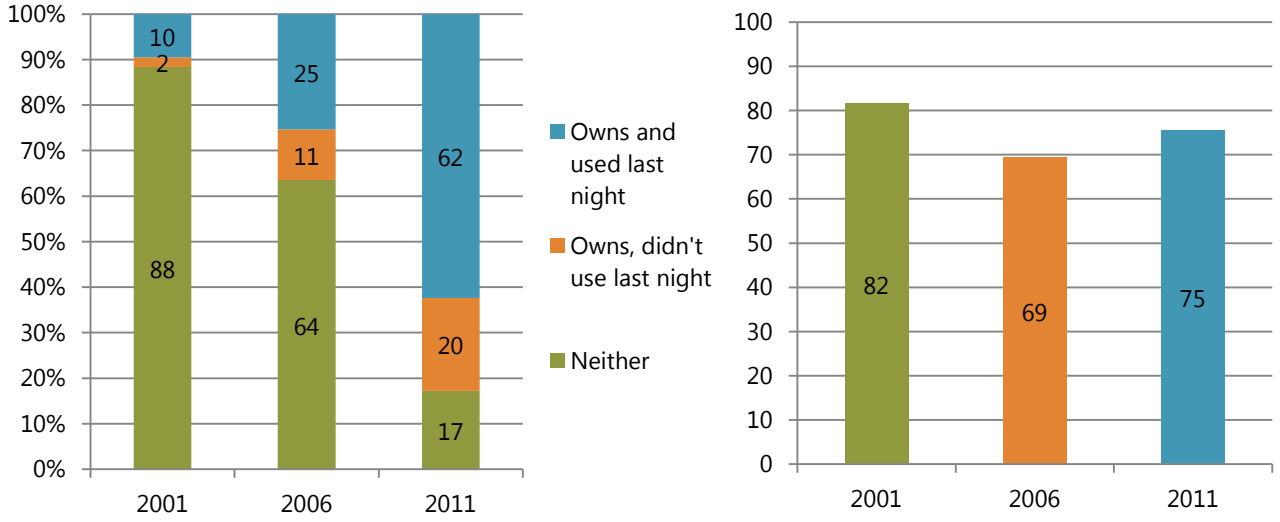
Figures 4.8, 4.9, 4.10, and 4.11 provide additional detail on bed net use. A high and relatively constant proportion of all 6–59m living in households that owned a bed net slept under one during the previous night. In Uganda, around 82 percent of bed net owners were sleeping under a bed net in 2001 and this remained largely constant, with 79 percent of children who owned bed nets sleeping under one in 2011.

[15] The deworming program is for children 12–24 months.

Figure 4.8. and 4.9. Among Children 6–23 Months, Bed Net Ownership and Use (left), and among Bed Net Owners, Proportion Sleeping Under One (right)



Figures 4.10. and 4.11. Among Children 24–59 Months, Bed Net Ownership and Use (Left) and among Bed Net Owners, Proportion Sleeping Under One (Right)



Dividing the number of bed net users by the total population of each of these target groups provides an estimate of the effective national bed net coverage of each of these sub-populations. Figures 4.12 and 4.13 show these figures by region and national totals for each of the two children's age groups. Nationwide, both of the children's age groups have had rates that are consistently above those of women. The youngest children have consistently had rates higher than the older children, and these rates are increasing. The older children's rates are increasing as well, and they are narrowing the difference between the age groups.

Figure 4.12. Change in Bed Net Use among Children 6–23 Months, by Region

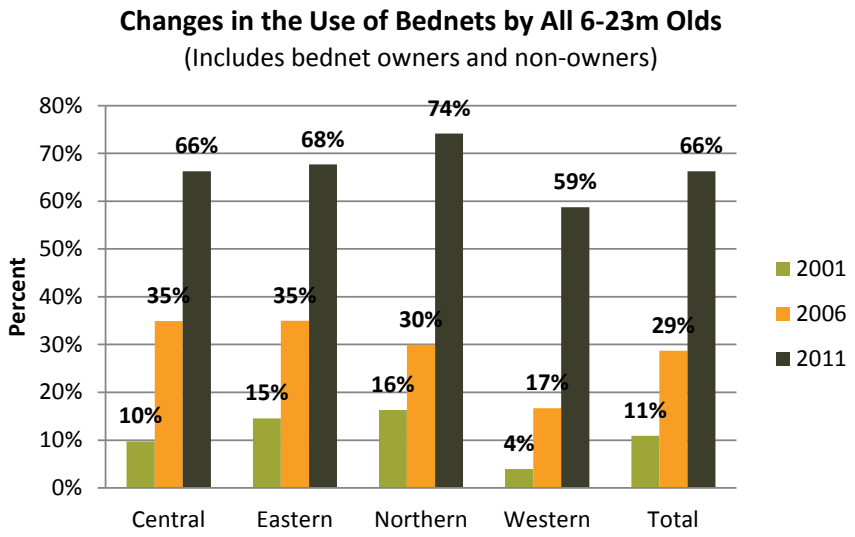
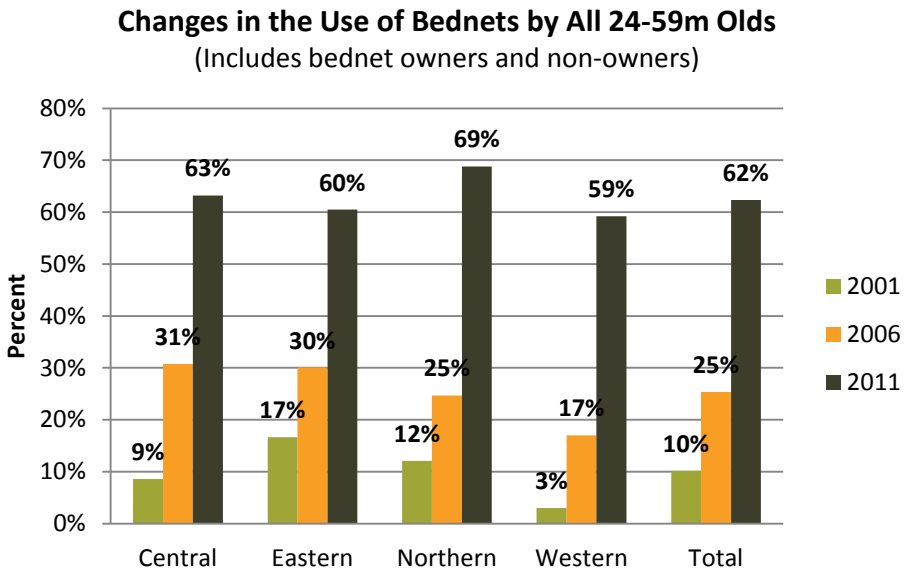


Figure 4.13. Change in Bed Net Use among Children 24–59 Months, by Region, 2001–2011



In other words, there is a growing trend in the effective bed net coverage of Ugandans. These increasing and converging effective rates of coverage are good news. The fact that women's rates are approaching the very high rates among children suggests that the progress that is being made in changing behaviors is not only widespread, but also more likely to be permanent, as the caretakers themselves are changing their own behaviors, and doing a better job of not only protecting themselves from malaria but also doing a better of helping their children avoid it.

Different patterns of ownership versus use emerge with regional analysis. For instance, the Western region (which has a lower level of endemnicity of malaria), lagged behind the national average in 2001 and 2006 in terms of both bed net ownership and use. Between 2001 and 2011, however, the Western region had the largest percentage point increase and the fastest pace of increase in use.

Ugandan Children's Growing Average Number of Anemia-related Program/Behaviors

Because anemia has many potential causes, when assessing the impact of changes in behaviors and program participation rates, it is important to consider both coverage rates of individual programs and the number and types of programs in which individual children participate. UDHS data allows analysis of the behavioral patterns of individual children.

There has been striking growth in the number of anemia-related programs and behaviors in which Ugandan children engage. In 2011, the number of children not practicing any such behaviors or participating in any such programs plummeted and the average number of practices/programs per child has grown steadily (see Table 4.3).

Table 4.3. Among Children 12–59 Months, Total Number of Interventions Received, 2006 and 2011

Number	Specific program combination	2006	2011
0	No programs	34.76	11.63
1	Deworming only	16.19	5.37
	Bed nets only	9.15	15.8
	Vitamin A only	8.45	6.86
	1 program	33.79	28.03
2	Deworming and bed nets	8.5	9.42
	Deworming and vitamin A	13.99	12.66
	Bed nets and vitamin A	2.68	11.72
	2 programs	25.17	33.8
3	All 3 programs	6.27	26.54

5.0 Discussion

Uganda has shown a remarkable reduction in anemia prevalence over the last five years. The reductions in anemia among children 6–59 months and WRA reflect broad-based gains by all strata of the population since 2006 that more than offset the 2001-2006 increases in prevalence rates.

The findings from this study show that while the gains since 2006 have been enjoyed widely, the rates of decline in anemia prevalence have varied, with some groups and strata experiencing relatively greater gains. Most of women's gains have been in mild anemia, whereas among children—especially among the youngest, 6–23m—there have been larger percentage point reductions and larger percentage declines in moderate and severe anemia.

5.1 Prevalence of Anemia in Women of Reproductive Age and Children 6–59 Months

- The prevalence rates among adolescent women remained lowest among all of the age groups, while the highest rates were among women 35 years and older and the differential remained constant.
- Anemia rates were lower among women with no children, and the differential remained roughly constant across the three survey periods (~7 percentage points).
- Between 2006 and 2011, all regions had reductions in anemia among women, but Western and Northern, the two regions that had the most severe problem in 2006, had the greatest reductions.
- In 2011, the proportion of women who had hemoglobin levels close to the anemia cut-off value were more likely to not be anemic, but were "anemia-vulnerable:" that is, just above the cut-off, and their anemia status would progress to mild with only a small change in hemoglobin levels.
- The percent of women who were anemia-vulnerable fell from 43 percent in 2006 to 29 percent in 2011, providing further evidence of the solid gains Ugandan women have made in reducing anemia since 2006.
- Among children 6–59 months, the prevalence of anemia was highest among 6–8m in 2001 and 2011; however, a 20-percentage point reduction was seen in this age group between 2001 and 2011.
- Male children were slightly more anemic than female children in both age groups.
- Rural areas had the largest percentage point anemia reductions among both women and children, with the rural-urban gap closing among women. The gap remained larger among children, which narrowed in 2006 but increased in 2011.

The findings suggest that the determinants of anemia in Uganda were influenced by a complex array of ecological, social, and biological factors. As expected, the prevalence was inversely correlated with wealth and women's education. However, it was interesting to note that urban-rural differences in anemia are decreasing in Uganda, as is the geographical distribution across the different regions of the country.

5.2 Program Participation and Changes in Individual and Household Behaviors

Since children and women are at high risk for anemia, this study identified and analyzed a subset of the specific interventions targeted toward these groups and patterns of changing program participation. The objectives in doing so were to:

1. Understand how the coverage and care-seeking behaviors among women and children may have changed in the last decade
2. Explore the role that anemia prevention and control packages—CDP and ANC—may have played in the increased rates of coverage and participation
3. Identify opportunities for: a) improving the coverage of these packages; b) promoting cross-program coordination in the delivery of other services and more comprehensive use of services by clients; and c) identifying opportunities to build on the progress that has been made.

The findings of the study showed that several behaviors might have contributed to reduction in prevalence of anemia among women and children over the last 10 years.

- One factor that almost surely contributed to reduced anemia was the large increases in ownership and use of insecticide bed net among both WRA and children under five. The changes in bed net use increased by 45 percentage points among women and 52 percentage points among children 6–59 months between 2001 and 2011.
- The provision of daily IFA supplementation during pregnancy, and administration of two doses of IPTp and one dose of anthelminthic medication has been part of the Uganda National Anemia Policy since 2002 and is part of the recommended ANC package. The distribution of free (insecticide-treated) bed nets was added in 2006. The findings of this study showed that IFA coverage increased, especially from 2006–2011, in all regions of the country. Likewise, the number of IFA tablets received and consumed by pregnant women worsened slightly from 2001 to 2006 but increased markedly from 2006 to 2011. However, the proportion of women ingesting between 90-180 tablets remains woefully inadequate: 88 percent of women with at least one ANC visit in the past five years received and ingested less than one-quarter of the recommended minimum of 90.
- The proportion of women receiving any three anemia-related ANC services changed significantly in the last decade. In 2006, almost 13 percent of women reported that they had received IFA and IPTp services during their last pregnancy. In 2011, the percentage of women reporting they had received both of those services increased to 16 percent. The proportion of women who reported using any three of the services more than doubled, from 11 percent in 2001 to 27 percent in 2011. However, only one-third of women reported receiving all three services in 2011, and the significant variation in the combinations of these services and the changing patterns with which they were provided suggests that although the performance of ANC has improved steadily in the last decade, there is plenty of room for improvement.
- Among 6–59 months, there was a remarkable growth in the number of anemia-related programs and behaviors in which Ugandan children engage. In 2001, 43 percent of all 6–23ms and 48 percent of 24–59ms did not participate in any anemia-related programs. These percentages fell noticeably over the following decade reaching roughly one-fifth that level in 2011, reflecting a major transformation in Ugandans' health-seeking behavior patterns. In 2006, the percentage of the older children who did not

participate in any program was 25 percent, nine percentage points higher than rate of younger children who did not participate in any programs, which was at 16 percent. At the same time, the number of children participating in all three programs went from nine percentage points to approximately 25 percentage points in 2011. Considering the three programs that children in both age groups have in common—deworming, vitamin A supplementation, and bed nets—among 6–23ms, the average (mean) number of programs has gone from 1.31 in 2006 to 1.63, an increase of 24 percent, and among 24–59m olds, it has increased even more; from 1.28 to 1.71, an increase of 34 percent.

The findings of the study show that several strategies for anemia prevention and control are in place in Uganda. These include iron supplementation for pregnant women, vitamin A supplementation for children, deworming, food fortification, and strong malaria prevention and control programs. The proportion of women and children participating in anemia-related interventions has also increased in the last decade.

However, the low coverage and participation of women and children in integrated maternal and child health programs indicate that both demand and supply issues may hamper health service use and program intake. For instance, despite having the focused ANC package and CDP programs in place, the Ugandan health care system has not commit to ensuring that all components of the package are implemented. It is well known that the public sector in Uganda has several shortfalls, including shortage of workers, inadequate supplies, unofficial charges, and public subsidies that do not reach the poorest (McPake et al. 1999). Various levels of effort are required to increase the availability and use of a focused ANC package for women and CDP for children. Additional research is needed to better understand provider and community perspectives on initiatives that could facilitate improvements of service delivery and facilitate implementation of the different components of the integrated package.

The findings of this study must be viewed with some caution due to a number of limitations in the analytic methodology. First, all studies based on cross-sectional survey data assessments of causality are problematic and all conclusions are based on hypothesis.

Second, it is possible that there was recall bias, especially with the questions regarding care-seeking behavior during pregnancy, taking IFA tablets, attending CDP programs, education of head of household (in case the interviewee was not the head of household), and even whether the individual slept under a net the night before the survey.

6.0 Conclusions

Over the course of the past decade, there have been significant changes in the health program coverage/participation rates, especially in the average number of programs that women and children have participated in. Although for reasons noted earlier, it cannot be concluded that these behavioral changes are responsible for the dramatic reduction in anemia since 2006, it is plausible that these behavioral changes have made important contributions to it.

The prevalence of anemia in Uganda has declined as prevention programs have expanded their reach. It is plausible that the combined efforts of many programs contributed to the decline. There have been dramatic improvements in malaria-prevention programs, which are likely to have had an important role in the reductions in anemia observed between 2006 and 2011. While it is impossible to show which program has been the most effective, it is clear that ongoing government-sponsored programs and integrated packages have positively influenced health-seeking behaviors of women and children.

However, anemia continues to be an endemic problem in Uganda, particularly among 6–23m. Although the focused ANC packages, CDP, malaria prevention and control, and other programs offer holistic anemia prevention and control strategies in the country, political, operational, and technical barriers must to overcome if these programs are to continue efforts to reduce anemia. It is also important that Uganda engage a broad range of stakeholders to sustain the momentum of the movement. Finally, strong political commitment and continued investment in anemia reduction is essential to sustain the gains made over the last decade, and to improve the nutrition and health status, and through that, the mental and physical capacity of Ugandan women of childbearing age and children under five.

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