CHAPTER 12

ANEMIA AMONG WOMEN AND CHILDREN

Anemia is a condition characterized by inadequate red blood cell volume and a low concentration of hemoglobin in the blood. Commonly, anemia is the final outcome of a nutritional deficiency of iron, folate, vitamin B_{12}, and other nutrients. Although many other causes of anemia have been identified (such as hemorrhage, infection, genetic disorders, and chronic disease), nutritional deficiency, primarily due to a lack of dietary iron, accounts for most cases. (INACG, 1979, 1989; DeMaeyer et al., 1989; Hercberg and Galan, 1992).

Anemia is known to have detrimental health implications, particularly for mothers and young children. Unfavorable pregnancy outcomes have been reported to be more common in anemic women than non-anemic women (INACG, 1989). Women with severe anemia can experience difficulty meeting oxygen transport requirements near and at delivery, especially if significant hemorrhage occurs. This may be an underlying cause of maternal death and antenatal and perinatal infant loss (Fleming, 1987; Omar et al., 1994; Thonneau et al., 1992). Iron-deficiency anemia in children is associated with impaired cognitive performance, motor development, coordination, language development, and scholastic achievement (Scrimshaw, 1984; Lozoff et al., 1991). Anemia increases morbidity from infectious diseases because it adversely affects several immune mechanisms.

Anemia due to iron deficiency is recognized as a major public health problem throughout the world. According to the epidemiological data collected from multiple countries by the World Health Organization, 35% of women and 43% of young children are affected by anemia worldwide. In developing countries, about 50% of women and young children are anemic. In the United States and Europe, the prevalence of anemia is 7% to 12% among women and

children. The highest overall rates of anemia are reported in southern Asia and certain regions of Africa (DeMaeyer et al., 1989).

12.1 Design and Methodology of the Anemia Studies

Since 1995, the Demographic and Health Surveys (DHS) program has been involved in testing women and children for anemia. A capillary blood sample was collected for women between the ages of 15 and 49 years and children from 6 to 35 months of age in all surveys conducted in Central Asia, as well as in Armenia to measure hemoglobin levels. In addition, the Reproductive Health Survey (RHS) in Azerbaijan in 2001 tested hemoglobin levels in children from 12 to 59 months of age and in the mothers of children under five years of age to measure anemia status.

For hemoglobin measurement, capillary blood was taken from the finger using sterile disposable lancets. Hemoglobin was measured in the blood using the HemoCue system, which detects the level of hemoglobin within one minute. The procedure was performed by specially trained medical personnel and confirmed to be accurate, precise, and suitable for the various field conditions.

Levels of anemia were classified as severe, moderate, or mild based on the hemoglobin concentration in the blood, according to criteria developed by the World Health Organization (DeMaeyer et al., 1989). Anemia was classified as severe when hemoglobin concentration was less than 7.0 g/dl; moderate when the hemoglobin concentration was 7.0–9.9 g/dl, and mild when the hemoglobin concentration was 10.0–11.9 g/dl (10–10.9 for pregnant women and children under the age of three years).[1]

12.2 Anemia Among Women

Table 12.2 presents the anemia rates for women in all six countries. The prevalence of anemia in five of these countries was far higher than is typically found in developed countries. The highest overall rate of anemia was found in Uzbekistan (60%), the lowest in Armenia (12%). Forty-seven percent of women in Turkmenistan, and 40% in Azerbaijan (where only the mothers of young children were measured), 38% in the Kyrgyz Republic, and 36% in Kazakhstan, were diagnosed as having some degree of anemia.

In all six countries, women residing in rural areas were more likely to be anemic than women living in urban areas. Women with any postsecondary education were less frequently anemic than women with less education. In the surveys where ethnic comparisons were possible (the Kyrgyz Republic and Kazakhstan), the prevalence of anemia was much lower among women of Russian ethnicity than among others (data not shown).

The assessment of moderate-to-severe anemia (hemoglobin level less than 10 g/dl) in five of the six countries showed a similar pattern: the highest rate in Uzbekistan (15%), with only Armenia exhibiting low prevalence of less than 5% (only 2%).

Findings from local areas within Kazakhstan and Uzbekistan from the DHS surveys

[1] The hemoglobin concentration in the blood is affected by the level of saturation of arterial blood with oxygen, and thus by altitude. Hurtado et al. developed altitude hemoglobin level adjustments for the CDC Pediatric Nutrition Surveillance System. For the population of the Kyrgyz Republic, which lives at altitudes that range from 488 meters to more than 3,000 meters above sea level, the high altitude is an important factor that could affect the level of hemoglobin in the blood and therefore should be considered in the calculation of anemia rates. For this reason, in the Kyrgyz Republic Demographic and Health Survey, the rates of anemia were calculated using high altitude adjustment equations.

Table 12.2
Percent of Women with Moderate-to-Severe Anemia and Any Anemia by Selected Characteristics
Among Women of Reproductive Age*
Eastern Europe and Eurasia: A Comparative Report

	Caucasus			Central Asia							
	Armenia, 2000		Azerbaijan, 2001†	Kazakhstan, 1999‡		Kyrgyz Rep., 1997		Turkmenistan, 2000		Uzbekistan, 1996	
Characteristic	Moderate-to-Severe	Any Anemia	Any Anemia	Moderate-to-Severe	Any Anemia	Moderate-to-Severe	Any Anemia	Moderate-to-Severe	Any Anemia	Moderate-to-Severe	Any Anemia
Total	2	12	40	9	36	11	38	10	47	15	60
Residence											
Urban	2	10	39	8	34	7	32	9	45	14	59
Rural	3	17	42	10	37	12	41	10	49	16	61
Age Group											
15–19	1	9	47	6	32	7	32	5	38	11	56
20–24	2	11	39	7	34	10	34	8	46	18	63
25–29	2	14	39	9	32	9	37	11	49	17	63
30–34	1	11	39	8	38	14	44	11	54	18	63
35–39	2	15	44	13	41	11	42	12	51	16	63
40–44	4	13	40	13	42	13	39	13	51	12	58
45–49	4	15	§	7	31	12	43	12	47	14	56
Education Level											
Secondary Incomplete	2	13	40	9	40	11‖	39‖	7	41	15‖	61‖
Secondary Complete	3	13	42	8	36			11	52		
Technicum	2	13	36	11	37	11	40	9	46	17	62
Postsecondary	2	9	36	7	30	8	33	7	41	11	55

* Considered to be 15–44 years in RHS and 15–49 years in DHS surveys.
† Only mothers of children aged 3–59 months were tested. Only results for all anemia are reported.
‡ Testing was limited to a subset of surveyed women.
§ Survey was limited to women aged 15–44 .
‖ Percentages for primary/secondary education level.

conducted there show that, in some areas, rates of anemia are substantially higher than the national rates. For instance, in severely environmentally damaged areas near the Aral Sea, anemia rates of over 70% were found among women of reproductive age (Sharmanov, 1998).

An analysis of DHS data from the countries in the region reveals differentials in anemia rates among women according to nutritional and reproductive health characteristics. These differences are shown only for Kazakhstan in Figure 12.2, although they exist in Uzbekistan, the Kyrgyz Republic, Turkmenistan, and Armenia as well. The prevalence of moderate-to-severe anemia is higher among women with a body mass index (BMI) under 18.5 than among women with a higher BMI. The prevalence of moderate-to-severe anemia among women with two or more births (11%) is almost twice as high as that among women with fewer than two births (6%). Women with average birth intervals of less than 24 months are more likely to have moderate-to-severe anemia (16%) than women with birth intervals of more than 24 months (12%). Among women using intrauterine devices (IUDs) as a method of contraception, the prevalence of moderate-to-severe anemia is twice as high as among women who are not using the IUD. This difference can be explained by the increased menstrual blood loss caused by using an IUD, which can lead to iron depletion and iron-deficiency anemia (INACG, 1989).

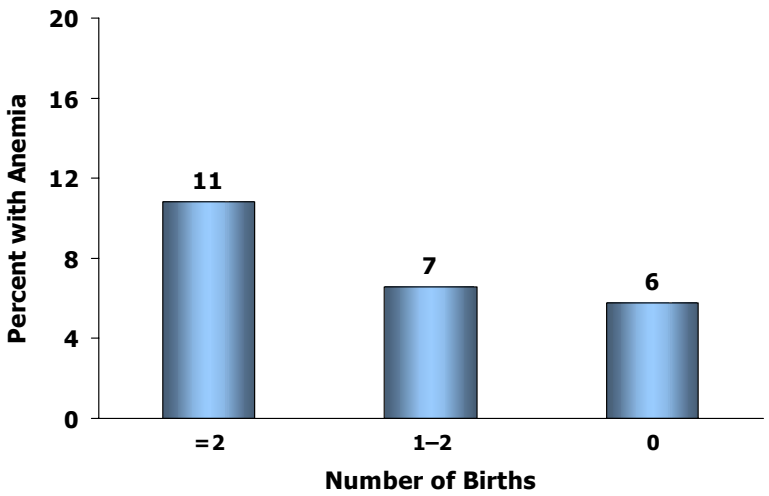
When iron deficiency is the main etiologic factor of anemia, population groups with high iron requirements are disproportionately affected and develop anemia more frequently. For this reason, when iron deficiency is highly prevalent in a population, pregnant women, who provide the fetus with a considerable amount of iron, are at greater risk of developing anemia than non-pregnant women. Hemoglobin data from the 1999 Kazakhstan DHS show that the entire hemoglobin distribution for pregnant women is shifted downward (i.e., is much lower) compared with the distribution for non-pregnant women. The hemoglobin distribution for breast-feeding women is also shifted downward compared with the distribution for non-pregnant and non-breast-feeding women, but to a lesser extent than the distribution for pregnant women (data not shown). Because of the gap between very high iron requirements and limited body iron reserves during pregnancy, routine iron supplementation is indicated for pregnant and postpartum women.

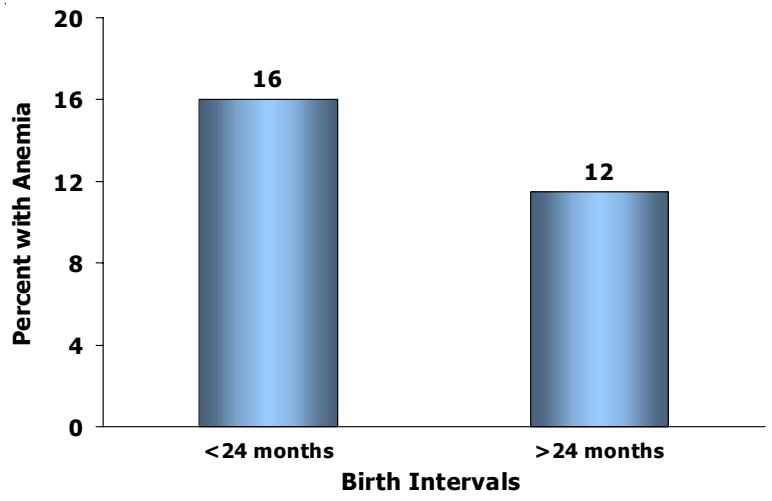
In the 1999 Kazakhstan and 2000 Turkmenistan surveys, women were asked if they received iron pills during their last pregnancy. In Kazakhstan, 48% of women received iron pills, taking them for an average of 22 days. On average, women there took iron pills for 22 days. Iron supplementation is more common among women with a higher education (56%) and women residing in urban areas (54%) than among women with only primary or secondary education (40%) and those who reside in rural areas (43%). Thus, despite efforts promoting iron supplementation, more than half of women in Kazakhstan did not receive iron supplements during their last pregnancy. Even women who received iron pills tended to take them for a shorter period than recommended.

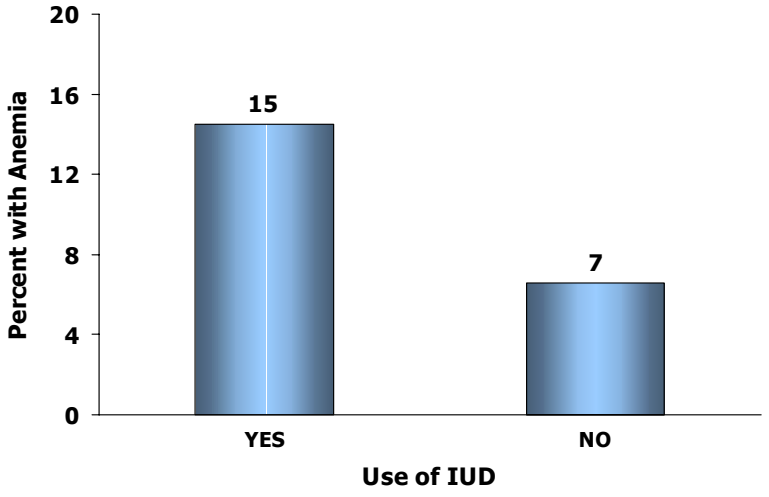
12.3 Anemia Among Children

Table 12.3 presents anemia rates for young children in Uzbekistan, the Kyrgyz Republic, Kazakhstan, Turkmenistan, Armenia, and Azerbaijan. As with women of childbearing age, the highest overall rate of anemia was observed in Uzbekistan (61%) and the lowest in Armenia (31%). The rates of anemia among children in the Kyrgyz Republic, Kazakhstan, Turkmenistan, and Azerbaijan were 50%, 48%, 44%, and 32%, respectively. While the

Figure 12.2
Nutritional and Reproductive Health Differentials of Anemia
in Kazakhstan
Eastern Europe and Eurasia: A Comparative Report







rates of moderate-to-severe anemia were lowest in Armenia (13%), they were quite similar in the four Central Asian republics, surveyed: ranging from 27% to 23%.

As with women, there were some differences in moderate-to-severe anemia rates among children according to sex, residence, and mother's education. In all countries for which data were available for moderate-to-severe anemia, boys were more likely to be anemic than girls. The prevalence of moderate-to-severe anemia among children living in rural areas was higher than among children living in urban areas, with the exception of Turkmenistan. Differences according to mother's education were inconsistent, though anemia rates tended to be higher for the children of women without postsecondary education. There were no substantial differences in rates of moderate-to-severe anemia among children by their mother's ethnicity, with the exception of Russian children living in Kazakhstan, whose rate of moderate-to-severe anemia (10%) was significantly lower than among the children of other ethnic groups (data not shown). There were no significant differences in the anemia rates among children by their birth order and birth intervals.

As with anemia among women, in Kazakhstan and Uzbekistan extremely high rates of anemia among young children were found in some environmentally damaged areas. Rates of anemia as high as 81% were found in some areas (Sharmanov, 1998).

12.4 Anemia Trends: Changes in the Prevalence of Anemia in Kazakhstan

Table 12.5 presents the rates of moderate-to-severe anemia among 15–49 year-old women and among children under age three in Kazakhstan based on the surveys conducted in 1995 and 1999. The results indicate a decline in the prevalence of moderate-to-severe anemia between the surveys among both women and children, falling from 12% to 9% among women and from 39% to 26% among children.

Despite the overall decline in the anemia rates, demographic and socioeconomic differentials in the prevalence of moderate-to-severe anemia in the 1999 KDHS followed almost the same pattern as in the 1995 KDHS. For example, in both surveys, the rate of anemia was the highest among women and children living in the West region. It is also higher for Kazakh women and children than it is for women and children of Russian or other ethnicities. Women and children residing in rural areas were more likely to demonstrate moderate-to-severe anemia than those in urban areas. The most pronounced decline was observed in the South region, where the moderate-to-severe anemia rate declined from 11% to 7% among women and from 40% to 20% among children.

It is important to note that the 1995 survey was conducted mostly during the period June through August, one month earlier than the 1999 survey, which took place from July through late September. The availability and consumption of fresh fruits and vegetables, and thus of essential vitamins and minerals, tends to be higher during the later period. This seasonal difference in diet could be an explanation for at least part of the observed decline in the prevalence of anemia in both women and children between 1995 and 1999.

The decline in the prevalence of anemia could also be the result of the positive effects of the anemia control and prevention program. In particular, the intensive iron supplementation program, which has recently been implemented

Table 12.3
Percent of Children with Moderate-to-Severe Anemia and Any Anemia by Selected Characteristics
Among Children Aged 6–35 Months
Eastern Europe and Eurasia: A Comparative Report

	Caucasus			Central Asia							
	Armenia, 2000		Azerbaijan, 2001*	Kazakhstan, 1999		Kyrgyz Rep., 1997		Turkmenistan, 2000		Uzbekistan, 1996	
Characteristic	Moderate-to-Severe	Any Anemia	Any Anemia	Moderate-to-Severe	Any Anemia	Moderate-to-Severe	Any Anemia	Moderate-to-Severe	Any Anemia	Moderate-to-Severe	Any Anemia
Total	13	31	32	26	48	25	50	23	44	27	61
Sex											
Boys	14	32	34	27	51	30	53	24	44	29	61
Girls	12	30	30	25	45	21	47	21	43	24	61
Birth order											
First	13	30	U	31	53	30	54	22	41	29	62
2–3	13	30	U	21	45	25	47	22	45	25	58
4–5	17	35	U	26	48	22	49	25	49	30	62
6+	†	†	U	35	39	26	56	21	44	26	76
Birth interval											
First	13	30	U	31	53	30	54	23	41	29	63
<24 months	13	33	U	18	55	25	49	24	46	26	61
24–47 months	13	32	U	28	44	25	48	21	44	26	58
>48 months	14	28	U	23	39	22	47	23	48	27	65
Residence											
Urban	7	21	32	19	40	18	39	26	50	25	58
Rural	19	41	31	30	53	28	53	20	40	28	62
Mother's Education Level											
Secondary Incomplete	27	44	34	14	47	26‡	51‡	19	47	28‡	63‡
Secondary Complete	13	32	33	36	57			22	41		
Technicum	11	30	26	21	43	26	50	24	48	26	57
Postsecondary	9	20	28	17	38	21	43	33	52	24	57

* Includes children aged 12–59 months.
† Fewer than 25 cases in this category.
‡ Percentages for primary/secondary education level.
U = Unavailable.

by UNICEF's Area Office for the Central Asian Republics and Kazakhstan (UNICEF/CARK) and the Kazakhstan Academy of Nutrition in Kyzylorda oblast (part of the 1999 KDHS South region) may benefit the overall iron status of women and children living in that area.

It has been suggested that the main cause of anemia in Kazakhstan is iron deficiency (Sharmanov, 1998). In the 1999 Kazakhstan DHS, a new approach was used to determine whether anemia in Kazakhstan is primarily due to a negative iron balance. This approach is based on comparative analysis of hemoglobin distribution curves for children, women, and men. In addition to women and children, the survey collected the hemoglobin data for a sub-sample of 539 men. The hemoglobin distribution curves for women and children are shifted downward compared with the curve for men, meaning men were less likely to have anemia (data not shown). This pattern is characteristic of populations where iron deficiency is the main cause of anemia, and confirms the suggestions that anemia among women and children in Kazakhstan is primarily due to negative iron balance.

Table 12.4
Percent of Women and Children with Moderate-to-Severe Anemia by Selected Characteristics Among Women Aged 15–49 and Children Aged 6–35 Months in Kazakhstan, 1995 and 1999
Eastern Europe and Eurasia: A Comparative Report

	Moderate-to-Severe Anemia Among Women Aged 15–49		Moderate-to-Severe Anemia Among Children Aged 6–35 Months	
	Kazakhstan, 1995	Kazakhstan, 1999	Kazakhstan, 1995	Kazakhstan, 1999
Characteristic	(%)	(%)	(%)	(%)
Total	12	9	39	26
Residence				
Urban	10	8	31	19
Rural	14	10	44	30
Region				
Almaty City	11	7	*	*
South	11	7	40	20
West	19	14	55	42
North-East-Central	10	9	34	28
Age Group				
15–19	7	6	NA	NA
20–24	12	7	NA	NA
25–29	11	8	NA	NA
30–34	14	8	NA	NA
35–39	14	13	NA	NA
40–44	11	13	NA	NA
45–49	16	7	NA	NA
(Mother's) Education Level				
Primary/Secondary	14	8	42	32
Technicum	12	11	38	22
Postsecondary	9	7	35	17
Ethnicity				
Kazkh	16	11	49	30
Russian	8	5	28	10
Other	9	8	20	23

* Fewer than 25 cases in this category.
NA = Not applicable.

12.5 Summary of Findings

These findings have provided important information for developing health intervention programs to prevent iron-deficiency anemia among women and children in these regions, particularly those subgroups of the population suffering the highest prevalence of anemia. On the basis of the results of the anemia studies conducted in Kazakhstan, Uzbekistan, and the Kyrgyz Republic in conjunction with the national DHS surveys, UNICEF proposed an integrated strategy of education, supplementation, fortification, and research to address the problem and called for donors' support.

The proposed strategy considered an intervention approach and includes the following elements (Gleason et al, 1998):

- National and area-wide education and training efforts aimed at affordable and acceptable change in the environments of economic transition;
- Fortification of cereal flour with iron;
- A major expansion of weekly iron supplementation for a period of two years to encompass women of reproductive age, children 6–24 months of age, and pregnant women;
- A research agenda of key studies and monitoring activities by the government and other institutions, beginning with a study of the effectiveness of weekly supplementation in all groups, and action research on communication channels, messages, and other factors that will be developed as part of the program.