

A limitation of this research is that it fails to provide a comprehensive overview of the prevalence, causes, and consequences of induced abortion in Armenia. A multicenter project is currently under way that will provide a broader and deeper understanding of the impact of the issue, including data on the morbidity associated with induced abortion and resources spent within hospitals to maintain abortion services. Nonetheless, because these data will not be available for several years, the present report serves notice of the potential problems engendered by family planning policies centered around induced abortion.

The historic decline of induced abortions—both legal and illegal—in Western countries has been an important component of the observed improvement in women's health.<sup>1,9</sup> The substitution of effective preventive contraceptives for abortion in Eastern European countries is a realistic goal because of their developed medical infra-

structures and because women in these countries have a relatively high level of education.

Current family planning policies based on induced abortion in Armenia and other Eastern European countries need to be critically evaluated. The full extent of such policies' adverse health effects and their associated economic costs requires better documentation. In the absence of an informed family planning policy, Eastern European women will continue to suffer preventable health consequences and scarce health resources will be inappropriately targeted. □

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# Anemia in Young Children of the Muynak District of Karakalpakstan, Uzbekistan: Prevalence, Type, and Correlates

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## Introduction

Uzbekistan is 1 of 5 Central Asian republics that gained their independence with the breakup of the former Soviet Union. The population boasts universal literacy, with high rates of fertility (3.73 children per woman) and infant mortality (53.2 per 1000 live births).<sup>1</sup> Independence has resulted in runaway inflation,<sup>2-4</sup> escalating unemployment, and increasing poverty.<sup>5</sup> A typical meal, especially for those in rural areas, consists of bread and potatoes with tea. Green vegetables, fruit, milk, and meat are beyond financial reach.<sup>6</sup>

In 1992, the Uzbek Ministry of Health Protection identified anemia among young children as a public health concern. The Ministry of Health Protection invited Crosslink International, a nongovernmental organization, to collaborate on a population-based study of anemia. The district of Muynak, located in the Aral Sea Basin in northern Uzbekistan, was selected for study. Under the

Soviet regime, water was siphoned from the Aral's 2 feeder rivers for irrigation to support an intensive cotton monoculture. Now the

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*Note.* Variant spellings for Muynak include *Muinak*, *Mujnak*, and *Muinoq*. The Board of Geographic Names has recently approved the new official Uzbek spelling *Muynoq*. The new official Uzbek spelling of Karakalpakstan is *Qoraqalpoghiston*; however, this spelling has not yet been approved by the Board.

## ABSTRACT

**Objectives.** This study examined prevalence and correlates of anemia in the Muynak District of Uzbekistan, an area of rapidly changing social and economic conditions following the collapse of the Soviet Union.

**Methods.** Questionnaire data and blood samples were collected on a random sample of 433 children aged 1 through 4 years.

**Results.** The prevalence of anemia ranged from 89% in 1-year-olds to 48% in 4-year-olds. Correlates for anemia included younger age, a communal water source, and a history of pica.

**Conclusions.** Anemia is a widespread problem in young children in this district. An aggressive attempt to reverse this problem is needed. (*Am J Public Health*. 1998;88:805-807)

Aral is a dead sea, covering only 60% of its previous area and with triple its previous salt content. The surrounding countryside has been severely polluted through liberal use of fertilizers, pesticides, and defoliants.<sup>7-10</sup>

## Methods

This study focuses on anemia in children aged 1 through 4 years, sampled in May and June 1993 as part of a population-wide survey. The sampling frame was based on the Muynak mayor's census, which included residents' name, birth year, and address, organized by location. Survey participants were selected as a systematic random sample of the entire census list by beginning with a random number from 1 to 10 and then selecting every 10th individual thereafter (for instance, the 9th, 19th, 29th, and so on). To increase the number of participants, the list was sampled twice completely, and a third time only for children born in 1992, an age class that was under-represented in the population. Children identified as potential participants were invited to come with a parent or guardian to the district hospital or a local health center. Transportation was provided as needed, and home visits were arranged in remote areas.

Hemoglobin level, mean corpuscular volume, and red cell distribution width were determined in the field with a JT-2 Coulter instrument. Presence and severity of anemia were defined according to World Health Organization (WHO) standards for this age group. The North Carolina State Health Laboratory performed hemoglobin electrophoresis on blotted filter paper. American Medical Laboratories Inc performed serum studies for ferritin, using the Ciba Corning Automated Chemiluminescence System (ACS) assay, and for iron, using the Boehringer Mannheim Corporation's direct photometric technique.

An interviewer-administered questionnaire, including 10 questions from an anemia risk factor checklist developed by the Uzbek Republican Hematological Institute of Tashkent, was used to identify potential correlates of anemia. Information on the child's age, sex, nationality, diet, health status, gestational age, birthweight, and history of pica was obtained from the accompanying parent or guardian at the time of examination. Information was also obtained on the parents' education and employment and socioeconomic status, the mother's history of anemia or toxemia during pregnancy, and the number of siblings and their birth intervals.

Of 655 age-eligible children invited to participate in the study, 492 (75%) were

**TABLE 1—Characteristics of Children Tested for Anemia (n = 433): Muynak District, Uzbekistan, 1993**

	No.	%
Age, mo		
12–23	125	28.9
24–35	102	23.6
36–47	127	29.3
48–59	79	18.2
Sex		
Male	210	48.5
Female	223	51.5
Nationality		
Karakalpak	242	55.9
Kazakh	189	43.6
Uzbek (1) or Russian (1)	2	0.4
Household size		
2–6 persons	219	50.6
7 or more	214	49.4
No. of siblings		
None	51	11.8
1 or 2	195	45.1
3 or more	186	43.1
Household characteristics		
Monthly income > 15 999 rubles <sup>a</sup>	42	9.7
Father employed	387	89.4
Mother employed	235	54.3
Electricity	428	98.8
Bottled gas (butane)	382	88.2
Television	389	89.8
Refrigerator	318	73.4
Radio	238	55.1
Telephone	184	42.5
Kitchen garden	224	51.9
Farm animals for milk	273	63.2
Farm animals for meat	174	40.2
Poultry	215	49.8

<sup>a</sup>Equivalent to US \$16.

examined. Among the nonrespondents, 54 children could not be located, 21 were excluded because of parental refusal, and 11 were deceased. No reason for lack of participation could be determined for the remaining 77 nonrespondents. There were no important geographic differences in response rates throughout the district.

## Results

Characteristics of the study cohort are presented in Table 1. In spite of high rates of education and employment, the median monthly household income (including government benefits) was only 8792 rubles, equivalent to US \$8.79 at the time of the survey. Most participating families had electricity, a television, and a refrigerator. Only about half had a radio, telephone, or garden, and only about one third had a private tap for water.

Hemoglobin measurements were obtained for 433 (88.0%) of the 492 participants. The mean hemoglobin level was 9.78 (SD = 1.80) g/dL. According to WHO crite-

ria, 72.5% of the children had anemia (26.3% mild, 38.8% moderate, and 7.4% severe). Hemoglobin electrophoresis results, obtained for 427 children, identified 1 abnormality typically associated with anemia. Mean corpuscular volume and mean levels of ferritin and iron were significantly lower, and mean red cell distribution width values were significantly higher, in children with anemia than in their nonanemic peers (Table 2). Of the 173 children with complete results for ferritin, iron, and red cell distribution width, 95 (55%) had 2 or more abnormal test results, indicative of iron deficiency.

In both simple and stepwise multiple logistic regression models, only age, history of pica, and primary household water source were significantly associated with anemia status ( $P < .05$ ). Age-specific anemia rates were 89%, 79%, 66%, and 48% for 1-, 2-, 3-, and 4-year-olds, respectively. The odds of anemia were 2.4 times greater in children with a history of pica than in those with no such history, and 2.4 times greater for children whose primary household water source was a communal tap than for those with a private household tap. No significant associ-

**TABLE 2—Mean Laboratory Test Values for Children Tested for Anemia (n = 433): Muynak District, Uzbekistan, 1993**

	Anemic Children		Nonanemic Children		All Children		P <sup>a</sup>
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	
Mean corpuscular volume, $\mu\text{m}^3$	314	64.34 (8.38)	119	76.94 (3.86)	433	67.80 (9.31)	.0001
Red cell distribution width, %	314	17.20 (3.19)	119	13.70 (1.65)	433	16.24 (3.25)	.0001
Ferritin, ng/mL	168	8.02 (11.27)	84	24.41 (32.23)	252	13.48 (21.82)	.0001
Iron, $\mu\text{g/dL}$	127	47.90 (44.59)	53	82.80 (48.22)	180	58.18 (50.56)	.0000

<sup>a</sup>For null hypothesis of no difference between anemic and nonanemic children; *t* test.

ations were detected between anemia and the child's sex, nationality, gestational age, birthweight, health history, or diet ( $P > .05$  in all cases). Similarly, no significant associations were detected between the child's anemia status and the parents' education, employment, socioeconomic status, or income; the mother's history of anemia or toxemia during pregnancy; or the number of or spacing between siblings.

### Discussion

The Muynak District has one of the highest estimated prevalences of anemia among young children in the world.<sup>11-14</sup> Laboratory tests confirm that iron-deficiency anemia is the primary form of anemia in this population. Because of the well-known deleterious effects of iron-deficiency anemia on early childhood development and morbidity, an aggressive attempt to reverse this problem is clearly indicated. Iron enrichment of commonly used foods should be explored. Development of agricultural techniques and produce that will grow in this arid area with salinated soil and development of the economic base of the community are also crucial. □

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