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Action Priorities for the Prevention of Iron Deficiency in Europe and North America: United States as a Case Example

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In industrialized European and North American countries with strong economies, diverse diets, and low infection rates, iron deficiency is now uncommon among men, but remains the most common known form of nutritional deficiency among infants, young children, and women of childbearing age. The purpose of this presentation is to describe the trends in iron deficiency, the strategies to reduce iron deficiency, and to define action priorities to prevent iron deficiency in industrialized countries. The United States is used as the primary case example.

In the U.S., significant reductions in the prevalence of iron deficiency and anemia among infants and young children occurred over the last three decades, likely related to improvements in iron nutrition with the Supplemental Nutrition Program for Women, Infants and Children (WIC). Among low-income U.S. children, for example, the prevalence of iron deficiency declined from 21% in 1976-80 to 13% in 1988-94. In contrast, among nonpregnant women of childbearing age the prevalence of iron deficiency did not decline from 1976-80 to 1988-94. The prevalence of anemia among low-income pregnant women in their third trimester has remained close to 30% since 1979. The prevalence of iron deficiency is highest among Mexican Americans, more than two times as high as among non-Hispanic white Americans.

The two main strategies to prevent iron deficiency include:

1. Primary prevention through increasing iron intake.
2. Secondary prevention through screening and treatment.

In infants and young children in the U.S., the major approach to increasing iron intake is the promotion of breastfeeding, iron-fortified formula when not breast feeding, and the consumption of age-appropriate iron containing and enhancing foods at weaning and beyond. From 1971 to 1991, the proportion of infants fed with cow's milk or with unfortified formula at 6 months of age declined, whereas the proportion of infants' breastfed or fed with iron-fortified infant formula increased from 13% to 84%. This change in patterns of milk intake is likely a factor in the decline in iron deficiency in this age group.

In women of reproductive age, the major approach to increasing iron intake is promotion of iron containing foods, including iron enriched and fortified foods, and iron supplementation during pregnancy. Data are limited on consumption of iron from

supplements during pregnancy. Data is also limited on the health effects of iron fortification for women of reproductive age. Beginning in the 1940s, the U.S. set enrichment standards to restore the iron in wheat flour to the same level as whole wheat in an effort to improve the nutritional quality of the food supply and the nutritional status of the population. Currently, the U.S. requires iron fortification of cereal grain products labeled as enriched with standards of identity. Canada requires iron fortification of flour, “enriched” pasta, cornmeal, and rice, for the purpose of restoration, and also permits fortification of breakfast cereals. From 1977 to 1978, enrichment and fortification of grain products in the U.S. provided 19% of the total dietary intake of iron for people 2 years and older and 15% of the total dietary intake of iron for women 23 to 50 years of age. More recent estimates are unavailable. Changes in consumption and fortification may have changed the contribution of enriched and fortified products to iron intake over time. From 1977 to 1978 and from 1994 to 1995, for example, the average daily amount of grain products consumed by U.S. women age 20 years and over increased by 44%. Total meat, poultry and fish consumption remained about the same, but the average amount of beef consumed declined by more than half. The quantity of iron intake has changed little over this period, but the bioavailability may have decreased due to changes in dietary patterns.

Concerns about the effects of excess iron for people with hemochromatosis have led some European countries to eliminate iron fortification or to recommend selective iron supplementation during pregnancy. Hemochromatosis, the most common cause of iron overload, occurs in 0.2% to 0.5% of people of Northern European descent. Prevention of the clinical manifestations of hemochromatosis involves early case detection and phlebotomy.

The evidence that iron fortification of foods leads to earlier iron overload is limited mainly to absorption studies and theoretical modeling. The exception is a recent study in Sweden that suggested that the withdrawal of iron fortification (the highest in the world) from flour in 1995 resulted in an average reduction in the amount of iron absorbed of 0.7 mg/day in 16 men with hemochromatosis. The interval between phlebotomy was also extended by an average of 10 days. Based on this study and theoretical modeling, people homozygous for hemochromatosis may accumulate excess iron earlier in life with iron fortification.

Without fortification, the prevalence of iron deficiency may increase among women of reproductive age. In Sweden, the level of iron fortification of flour was increased from 30 mg/kg in 1943 to 50 mg/kg in 1963 and 65 mg/kg in 1970. A population study indicated that from 1963 to 1964, 25%-30% of women of reproductive age were anemic primarily due to iron deficiency. Later population studies in the same area from 1968-1969 and 1974 to 1975 indicated 5%-7% of women were anemic. An analysis suggested that at least 25% of the decline (7-8 percentage points) was attributed to iron fortification. The remainder was attributed to greater prescription of iron tablets, use of ascorbic acid supplements, and use of oral contraceptive pills, highlighting the need for multiple strategies to prevent iron deficiency.

Action priorities for industrialized countries in Europe and North America include monitoring the prevalence of iron deficiency among women of reproductive age with changes in iron enrichment and fortification. Action priorities to prevent iron deficiency in the U.S. include continuing to promote adequate iron intake among infants, young children, and females of childbearing age. In the U.S., a national health objective for the year 2010 is to reduce the ethnic and income disparities in the prevalence of iron deficiency. Participation of low-income women and children in WIC has increased since 1985 but could be expanded with additional funds. New approaches, including better screening and treatment, iron supplementation or targeted fortification of foods, may be warranted for population subgroups with high rates of iron deficiency. Finally the lack of improvement in the prevalence of iron deficiency and anemia among women of childbearing age may require further investigation and action.