Prevalence of Iron Deficiency Using 3 Definitions Among Women in the US and Canada

James C. Barton, MD; Howard W. Wiener, PhD; Jackson C. Barton, BS; Ronald T. Acton, PhD

Abstract

**IMPORTANCE** The prevalence of iron deficiency varies widely according to how it is defined.

**OBJECTIVE** To compare the prevalence of iron deficiency among women using 3 different definitions.

**DESIGN, SETTING, AND PARTICIPANTS** The cross-sectional Hemochromatosis and Iron Overload Screening Study (HEIRS; 2000-2006) evaluated the prevalence, determinants, and outcomes of hemochromatosis and other iron-related disorders. Multiethnic, primary care–based screening (2001-2003) was performed at 5 field centers (4 in the US and 1 in Canada). Volunteer women aged 25 years and older were recruited at primary care venues associated with the field centers. Data were analyzed from June to December 2023.

**MAIN OUTCOMES AND MEASURES** Measures included transferrin saturation, serum ferritin level, and self-reported age, pregnancy, and race and ethnicity. Three iron deficiency definitions were studied: (1) combined transferrin saturation less than 10% and serum ferritin less than 15 ng/mL (HEIRS), (2) serum ferritin less than 15 ng/mL (World Health Organization [WHO]), and (3) serum ferritin less than 25 ng/mL (a threshold for iron-deficient erythropoiesis [IDE]).

**RESULTS** Among 62,685 women (mean [SD] age, 49.58 [14.27] years), 1957 women (3.12%) had iron deficiency according to the HEIRS definition, 4659 women (7.43%) had iron deficiency according to the WHO definition, and 9611 women (15.33%) had iron deficiency according to the IDE definition. Among 40,381 women aged 25 to 54 years, 1801 women (4.46%) had iron deficiency according to HEIRS, 4267 women (10.57%) had iron deficiency according to WHO, and 8573 women (21.23%) had iron deficiency according to IDE. Prevalence rates of iron deficiency among 2039 women aged 25 to 44 years who reported pregnancy were 5.44% (111 women) according to HEIRS, 18.05% (368 women) according to WHO, and 36.10% (736 women) according to IDE. Iron deficiency prevalence by the 3 respective definitions increased significantly in each racial and ethnic group and was significantly higher among Black and Hispanic participants than Asian and White participants. The relative iron deficiency prevalence among the 62,685 women increased 2.4-fold (95% CI, 2.3-2.5; P < .001) using the WHO definition and increased 4.9-fold (95% CI, 4.7-5.2; P < .001) using the IDE definition.

**CONCLUSIONS AND RELEVANCE** Three definitions of iron deficiency were associated with significantly different prevalence of iron deficiency in women, regardless of self-reported age, pregnancy, or race and ethnicity. Using higher serum ferritin thresholds to define iron deficiency could lead to diagnosis and treatment of more women with iron deficiency and greater reduction of iron deficiency–related morbidity.

Key Points

**Question** Is the definition of iron deficiency, a common disorder that causes substantial morbidity in women, significantly associated with population prevalence estimates of iron deficiency?

**Findings** In this cross-sectional, primary care–based study of 62,685 women in the US and Canada, 3 definitions of iron deficiency were associated with significantly different prevalence rates of iron deficiency, regardless of self-reported age, pregnancy, or race and ethnicity.

**Meaning** These findings suggest that using higher serum ferritin thresholds to define iron deficiency could lead to diagnosis and treatment of more women with iron deficiency and greater reduction of iron deficiency–related morbidity.


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Introduction

Iron deficiency (ID) affects more than 2 billion people worldwide, especially young women and children. In women, ID increases risks of fatigue, impaired muscular performance, cold intolerance, mucosal and epithelial abnormalities, pica, disturbances of menstruation, and adverse pregnancy outcomes. There are few reports of ID prevalence in women in cross-sectional population cohorts in the US, US and Canada, or Canada.

The clinical laboratory diagnosis of ID has traditionally been defined by low serum iron, low transferrin saturation (TS), and low serum ferritin (SF), whereas many population studies define ID by SF alone. The Hemochromatosis and Iron Overload Screening Study (HEIRS) recruited a multiethnic, primary care–based sample of adults aged 25 years and older in the US and Canada (2001-2003) and defined ID in women as combined TS less than 10% and SF less than 15 ng/mL (to convert to micrograms per liter, multiply by 1). On the basis of expert recommendations, the World Health Organization (WHO) defines ID in persons older than 5 years in global populations as SF less than 15 ng/mL. A study based on data from National Health and Nutrition Examination Survey (NHANES; 2003-2006, 2007-2010, and 2015-2018) defined iron-deficient erythropoiesis (IDE) in nonpregnant US women aged 15 to 49 years as SF less than 25 ng/mL.

The aim of this study was to compare ID prevalence in the HEIRS Study cohort of women using these 3 definitions. We selected the HEIRS definition because it was used to determine associations of ID with HFE p.C282Y (rs1800562) and p.H63D (rs1799945) in the same group of women. Shortly thereafter, the WHO published a new ID definition. We selected this definition because experts predicted that ID prevalence according to the WHO definition would be several-fold higher in women than that observed using the HEIRS definition. We selected the third definition because it reflects SF at the outset of IDE in nonpregnant US women. We compared prevalence estimates in the following groups of women: the entire HEIRS Study cohort, those aged 25 to 54 years, those aged 25 to 44 years with self-reported pregnancy, and those from different self-reported racial and ethnic groups. We discuss ID prevalence estimates from the present and other large US and Canada cohorts of women and discuss implications of these estimates for population studies and clinical practice guidelines.

Methods

Ethical Approval, Informed Consent, and Participants

This cross-sectional study was conducted in accordance with the principles of the Declaration of Helsinki. The National Institutes of Health HEIRS Study (January 2000-June 2006) evaluated the prevalence, genetic and environmental determinants, and potential clinical, personal, and societal outcomes of hemochromatosis, iron overload, and iron-related disorders in a multiethnic, primary care–based sample of 101,168 adults enrolled from 2001 to 2003 at 4 field centers in the US and 1 in Canada.

The institutional review board of each field center approved the study protocol. The review boards included The University of Alabama at Birmingham Institutional Review Board for Human Use (Birmingham, Alabama), University of California Irvine Institutional Review Board (Irvine, California), Howard University Institutional Review Board (Washington, DC), Kaiser Permanente Northwest Region Institutional Review Board (Portland, Oregon), Kaiser Permanente Hawaii Region Institutional Review Board (Honolulu, Hawaii), and University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (London, Ontario, Canada).

Volunteer initial screening participants aged 25 years and older who gave written informed consent were recruited from a health maintenance organization, diagnostic blood collection centers, and public and private offices associated with the field centers that served ethnically and socioeconomically diverse primary care patients. We included all women who had not learned of the HEIRS Study from a participating family member or reported a previous hemochromatosis or iron overload.
overload diagnosis and those whose data pertinent to the present study were complete. Data collected included age, sex, self-reported race and ethnicity, TS and SF, previous hemochromatosis or iron overload diagnoses, HFE genotype, attitudes about genetic screening, and pregnancy. Evaluating other health measures or collecting socioeconomic data was beyond the scope of initial screening. This report follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cross-sectional studies.

Definitions of Race and Ethnicity
Data on race and ethnicity are included in this study because iron measures are known to differ among different racial and ethnic groups. The National Heart, Lung, and Blood Institute and the National Human Genome Research Institute specified that the HEIRS Study use these participant race and ethnicity classifications determined by self-reported answers to 2 questions: one regarding Hispanic background and another offering a nonexclusive choice of 5 racial and ethnic groups. Participants who identified themselves as having Hispanic, Latino, or Spanish heritage were classified as Hispanic, regardless of additional race and ethnicity identification or field center. Self-identified Asian participants were so classified. Black participants included self-identified African American and non-Hispanic Black participants recruited at US field centers (most in central Alabama and Washington, DC) and self-identified African, Black, Haitian, Jamaican, or Somali participants recruited at the London, Ontario Field Center. Participants who identified themselves as American Indian or Alaska Native at US field centers (or Inuit, Meti, or North American Indian at the London, Ontario Field Center only) were classified as Native Americans. Participants who reported 2 or more racial and ethnic groups or unknown race and ethnicity were classified as other. Participants who reported any Hawaiian or other Pacific Islander heritage were classified as Pacific Islander. Participants who identified themselves as non-Hispanic White or Caucasian were classified as White.

Definition of Pregnancy and Laboratory Methods
Pregnancy was defined by self-report. Blood samples were obtained from each participant at initial screening for measurement of TS and SF without regard for state of fasting or time of day. The HEIRS Study Central Laboratory (Advanced Research and Diagnostic Laboratory at the University of Minnesota, Minneapolis) performed all screening tests, except TS measurements for London Health Sciences Centre participants (performed by MDS Laboratory Services, Canada, using an identical method). Measurements included spectrophotometric serum iron and unsaturated iron-binding capacity, turbidometric immunoassay of SF (Roche Diagnostics/Hitachi 911), and calculated total iron-binding capacity and TS. Variability of each TS and SF batch was determined by analysis of routine internal laboratory quality control pools. For TS and SF, the batch-to-batch coefficients of variation were 3.0% and 4.7%, respectively. TS and SF correlation coefficients of participant values and blind replicates were 0.98 and 0.99, respectively.

Definitions of ID
We classified ID using these 3 definitions: combined initial screening TS less than 10% and initial screening SF less than 15 ng/mL (HEIRS), SF less than 15 ng/mL (WHO), and SF less than 25 ng/mL (IDE). The WHO definition of ID in adults and pregnant women is SF less than 15 ng/mL. We found no evidence that the SF definition of ID differs in adults of different ages or in women with and without pregnancy.

Statistical Analysis
We analyzed prevalences of ID in age groups of women in this study that reflect age groups in our preceding study. We evaluated women aged 25 to 44 years because this group included most pregnant women. The ID prevalence previously classified by the HEIRS definition among women aged 25 to 54 years was significantly greater than the ID prevalence among women aged 55 years.
and older, regardless of race and ethnicity. Thus, we also analyzed data of women aged 25 to 54 years in the present study.

We compared ages of racial and ethnic groups using an analysis of variance test. Percentages were compared using the likelihood ratio \( \chi^2 \) test or Fisher exact test (2-tailed), as appropriate. Mean values were compared using the \( t \) test (2-tailed) for 2 groups or the \( F \) statistic from a linear model for more than 2 groups.

We calculated relative (fold) increases of ID prevalences across age groups and racial and ethnic subgroups as quotients of ID prevalence estimates classified using WHO and IDE definitions of ID by ID prevalence estimates classified using the HEIRS ID definition. Random samples of individuals were generated that had approximately the same proportions of affected individuals as the observed samples for each definition of ID. This process was done for 100,000 randomly generated samples. The respective 95% CIs for the relative (fold) increases were defined as the 2.5 to 97.5 percentile intervals of the 100,000 generated ratios.

Data were analyzed from June to December 2023 with SAS statistical software version 9.0 (SAS Institute), Excel version 2000 (Microsoft), and Prism software version 8 (GraphPad Software). \( P < .05 \) was defined as statistically significant.

Results

General Characteristics of the Total Cohort
The mean (SD) age of all 62,685 women was 49.58 (14.27) years. Participants included 7615 Asian, 17,272 Black, 8566 Hispanic, 441 Native American, 449 Pacific Islander, and 27,079 White women and 1263 women identifying as other races. Mean ages of women grouped by race and ethnicity were significantly different (Table). The mean (SD) TS was 26% (12%), and the mean (SD) SF was 107 (145) ng/mL. In total, 1957 women (3.12%) had ID according to the HEIRS definition, 4659 (7.43%) had ID according to the WHO definition, and 9611 (15.33%) had ID according to the IDE definition. These prevalences differed significantly.

Women Aged 25 to 54 Years
Absolute Prevalence of ID
Among 40,381 women aged 25 to 54 years, the mean (SD) TS was 26% (12%), and the mean (SD) SF was 83 (129) ng/mL. According to the HEIRS definition, 1801 women (4.46%) had ID, 4267 women (10.57%) had ID according to the WHO definition, and 8573 women (21.23%) had ID according to the IDE definition.

ID prevalences differed across racial and ethnic groups (Figure 1 and eTable 1 in Supplement 1). Prevalences within each racial and ethnic group were significantly greater with WHO and IDE definitions than with the HEIRS definition. Prevalences were highest among Hispanic and Native American women and lowest among Asian women (Figure 1 and eTable 1 in Supplement 1).

Table. Mean Ages of Women in the Hemochromatosis and Iron Overload Screening Study

<table>
<thead>
<tr>
<th>Race and ethnicity</th>
<th>Participants, No. ( (N = 62,685) )</th>
<th>Age, mean (SD), y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian</td>
<td>7615</td>
<td>50.04 (13.30)</td>
</tr>
<tr>
<td>Black</td>
<td>17,272</td>
<td>48.69 (14.48)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>8566</td>
<td>43.91 (13.03)</td>
</tr>
<tr>
<td>Native American</td>
<td>441</td>
<td>47.61 (13.97)</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>449</td>
<td>51.82 (13.96)</td>
</tr>
<tr>
<td>White</td>
<td>27,079</td>
<td>51.81 (14.22)</td>
</tr>
<tr>
<td>Other*</td>
<td>1263</td>
<td>49.84 (13.50)</td>
</tr>
</tbody>
</table>

* Women who reported 2 or more racial and ethnic groups or unknown race and ethnicity were classified as other.
Relative Prevalence of ID
Among 40,381 women aged 25 to 54 years, the overall ID prevalence increased 2.4-fold (95% CI, 2.2-2.5; \( P < .001 \)) by the WHO definition and 4.8-fold (95% CI, 4.5-5.0; \( P < .001 \)) by the IDE definition. Relative increases were highest among White participants (3.0-fold for WHO and 6.7-fold for IDE) and lowest among Black participants (2.0-fold for WHO and 3.7-fold for IDE) and Native American participants (2.3-fold for WHO and 3.6-fold for IDE) (Figure 2 and eTable 2 in Supplement 1).

Prevalence of ID Among Women Aged 25 to 44 Years Who Reported Pregnancy
Pregnancy was reported by 2039 of 62,685 women (3.25%), including 181 of 7615 Asian women (2.38%), 369 of 17,272 Black women (2.14%), 563 of 85,666 Hispanic women (6.57%), 20 of 441 Native American women (4.54%), 16 of 449 Pacific Islander women (3.56%), 862 of 27,079 White women (3.18%), and 28 of 1263 women identifying as other races and ethnicities (2.22%). Differences in percentages of pregnant women across all racial and ethnic groups were significant. The overall prevalence of ID among women who reported pregnancy increased according to the definition used, from 111 women (5.44%) for HEIRS, to 368 women (18.05%) for WHO, and 736 women (36.10%) for IDE (eTable 3 in Supplement 1).

Figure 1. Absolute Prevalence of Iron Deficiency Among 40,381 Women Aged 25 to 54 Years

Iron deficiency was defined according to 3 definitions: Hemochromatosis and Iron Overload Screening (HEIRS) Study, World Health Organization (WHO), and iron-deficient erythropoiesis (IDE). Women who reported 2 or more racial and ethnic groups or unknown race and ethnicity were classified as other. Error bars denote 95% CIs.

Figure 2. Relative Prevalence of Iron Deficiency Among 40,381 Women Aged 25 to 54 Years

Iron deficiency was defined according to 3 definitions: Hemochromatosis and Iron Overload Screening (HEIRS) Study, World Health Organization (WHO), and iron-deficient erythropoiesis (IDE). Women who reported 2 or more racial and ethnic groups or unknown race and ethnicity were classified as other. Error bars denote 95% CIs.
Racial and Ethnic Groups

Absolute Prevalence of ID

The prevalence of ID across racial and ethnic groups differed significantly. The prevalence within each racial and ethnic group increased significantly according to the definition used, from 1957 women (3.12%) for HEIRS, to 459 women (7.43%) for WHO, and 961 women (15.33%) for IDE (Figure 3 and eTable 4 in Supplement 1). Prevalences among Black and Hispanic women were higher than those among Asian and White women (Figure 3) (eTable 4 in Supplement 1). Prevalences among women who identified as Native American, Pacific Islander, or other races and ethnicities were higher than those who identified as Asian or White, although numbers of women identifying as Native American, Pacific Islander, or other races and ethnicities were low.

Relative Prevalence of ID

The overall relative ID prevalence among 62,685 women increased 2.4-fold (95% CI, 2.3-2.5; \(P < .001\)) using the WHO definition and 4.9-fold (95% CI, 4.7-5.2; \(P < .001\)) using the IDE definition. Relative increases were highest among White participants (3.0-fold for WHO and 6.9-fold for IDE) and lowest among Black participants (2.0-fold for WHO and 3.8-fold for IDE) and Native American participants (2.2-fold for WHO and 3.7-fold for IDE) (Figure 4 and eTable 5 in Supplement 1).

Figure 3. Absolute Prevalence of Iron Deficiency Among Entire Cohort of 62,685 Women

Figure 4. Relative Prevalence of Iron Deficiency Among Entire Cohort of 62,685 Women

Iron deficiency was defined according to 3 definitions: Hemochromatosis and Iron Overload Screening (HEIRS) Study, World Health Organization (WHO), and iron-deficient erythropoiesis (IDE). Women who reported 2 or more racial and ethnic groups or unknown race and ethnicity were classified as other. Error bars denote 95% CIs.
Discussion

The results of this cross-sectional study of women in the US and Canada reveal that the prevalence of ID differed according to the definition used, regardless of self-reported age, pregnancy, or race and ethnicity. Strengths of this study include a large cohort of women aged 25 years and older from 7 racial and ethnic groups who participated in a primary care–based screening study and the use of current technology to measure TS and SF. We analyzed ID prevalence using 3 definitions: HEIRS (combined subnormal transferrin-bound iron and storage iron depletion, especially macrophage and hepatocyte stores), WHO (SF levels that represent storage iron depletion), and the onset of IDE (derived from NHANES data). Manifestations of ID, including anemia, are less prevalent or less severe in adults with higher SF. Thus, the 3 present definitions correspond, in sequence, to ID of increasing prevalence and decreasing severity.

A previous study of central laboratory data for 644,066 nonpregnant female individuals aged 15 to 54 years in Ontario, Canada (2017-2019), revealed that 14.4% had SF less than 15 ng/mL and 38.3% had SF less than 30 ng/mL. In 3490 nonpregnant US female NHANES participants aged 12 to 21 years, the ID prevalence was 17.0% defined by SF less than 15 ng/mL, 38.6% defined by SF less than 25 ng/mL, and 77.5% defined by SF less than 50 ng/mL. Together, these observations demonstrate that there is an association of higher SF definitions of ID with higher prevalences of ID among women. On the basis of the assumption that the HEIRS Study cohort is representative of US women in 2022, the estimated numbers of US women aged 25 to 54 years with ID according to the present definitions are 1.41 million for SF less than 15 ng/mL, 3.34 million for SF less than 25 ng/mL, and 6.73 million for SF less than 50 ng/mL.

Overall ID prevalence estimates were highest among women aged 25 to 54 years. ID prevalence within each racial and ethnic subgroup of women aged 25 to 54 years increased significantly from the HEIRS definition to the WHO definition and the IDE definition. The highest relative prevalence increases in ID classified by WHO and IDE definitions were observed in White and Pacific Islander women. In a previous study, ID prevalence classified by the HEIRS definition in women aged 55 years and older was significantly lower than that of younger women, regardless of race and ethnicity.

The present cohort included 2039 women aged 25 to 44 years (3.25%) with self-reported pregnancy. Percentages of women who reported pregnancy differed across racial and ethnic groups. By the 3 different definitions, the prevalences of ID in each racial and ethnic group were higher in the order HEIRS, then WHO, and finally IDE. The WHO has reported elsewhere that the most commonly used SF definitions of ID in pregnancy are less than 12 ng/mL and less than 15 ng/mL, that most studies provided no justification for the choice of SF used to define ID in pregnancy, and that unified international definitions for ID throughout pregnancy are needed. According to the present results, we infer that using a higher SF threshold to diagnose ID in pregnancy (<25 ng/mL) could lead to treatment of a greater proportion of pregnant women with ID and greater reduction of ID-related maternal and fetal and/or child morbidity, especially in pregnant women who do not take, tolerate, or benefit from supplemental iron.

In the present study, ID prevalence among racial and ethnic groups increased significantly in the order HEIRS, then WHO, and finally IDE. Overall ID prevalences among Black or Hispanic women were significantly higher than those of Asian or White women for each definition we studied. These differences could be explained, in part, by the lower mean ages of Black and Hispanic women than Asian and White women. Racial and ethnic differences in onset and duration of menses, numbers of children per mother, and breastfeeding could also account for some differences in prevalence we observed. In the present study, relative increases in ID prevalence with WHO and IDE definitions were highest in White women and lowest in Black and Native American women.

The WHO classifies the following magnitudes of ID (SF <15 ng/mL) prevalence as public health problems: prevalence less than or equal to 4.9%, no public health problem; prevalence 5.0% to 19.9%, mild public health problem; prevalence 20.0% to 39.9%, moderate public health problem; and prevalence 40.0% or greater, high magnitude of public health problem.
definitions, the aggregate ID prevalence of the present HEIRS Study cohort of women and the ID prevalence in women of all HEIRS Study racial and ethnic subgroups are categorized as mild public health problems.\(^5\) In the present study, according to the IDE definition, ID prevalence is a moderate public health problem among Hispanic and Native American women, regardless of age, and a moderate public health problem among women aged 25 to 54 years who identified as Black, Hispanic, Native American, and Pacific Islander. It is unknown whether the WHO would regard identical ID prevalences defined by different SF thresholds as equivalent public health problems.

For clinicians, no single SF definition of ID corresponds perfectly to the continuum of laboratory and clinical abnormalities that occurs when storage iron is reduced or absent.\(^6\) Instead of the presence or absence of inflammatory conditions.\(^3\) Correlation of stainable bone marrow iron in patients or healthy individuals and in patients with anemia responsive to iron therapy indicates that SF less than or equal to 12 ng/mL is a marker of absolute ID, regardless of the presence or absence of inflammatory conditions.\(^4\) Using the definition of SF less than or equal to 30 ng/mL, sensitivity for detecting ID increased to 92\%, with a positive predictive value of 83\%.\(^4\) In a systematic review,\(^4\) there was insufficient evidence to know whether SF less than 30 ng/mL is a reasonably sensitive and specific test for ID when screening asymptomatic persons.

Limitations

Limitations of this study are lack of observations for women who reside outside the US and Canada, participants younger than 25 years, male individuals, and hemoglobin levels. The present TS and SF were measured using single specimens collected at various times, although restricting specimen collections for TS and SF measurements to a specific time does not improve clinical utility of the results.\(^46\) Day-to-day variation also occurs in TS and SF, although TS and SF measurements in single specimens adequately reflect iron status.\(^48\)\(^49\) The HEIRS Study defined pregnancy of participants by self-report only. Collecting socioeconomic data and evaluating laboratory measures other than TS, SF, and HFE genotype were beyond the scope of the HEIRS Study initial screening.

Uncertainties of this study include whether different methods of measuring SF would yield significantly different results than we report. The present HEIRS Study cohort included all participants, regardless of TS and SF phenotypes or HFE genotypes.\(^2\) In women, the prevalence of the hemochromatosis-related HFE genotype p.C282Y homozygosity was greatest in non-Hispanic White participants (1 in 204 women).\(^2\) The prevalence of p.C282Y homozygosity did not differ significantly in women with or without ID, regardless of age, pregnancy, or race and ethnicity.\(^14\) Accordingly, it is unlikely that the present ID prevalence estimates were confounded by including women with p.C282Y homozygosity. Differences in diet and dietary iron content could account in part for differences in ID prevalence, especially across racial and ethnic groups, although corresponding data for initial screening participants were not available. It has not been reported whether the IDE physiologically based definition of ID\(^12\) is valid for the study of pregnant women or women aged 50 years and older, has been confirmed in other studies, and has been adopted in other population studies or clinical practice guidelines.

Conclusions

Three definitions of ID were associated with significantly different prevalences of ID in women, regardless of self-reported age, pregnancy, or race and ethnicity. Using higher SF thresholds to define ID could lead to diagnosis and treatment of more women with ID and greater reduction of related morbidity.
ARTICLE INFORMATION
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Author Contributions: Drs James C. Barton and Wiener had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: James C. Barton, Acton.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: All authors.
Critical review of the manuscript for important intellectual content: James C. Barton, Jackson C. Barton, Acton.
Statistical analysis: All authors.
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Administrative, technical, or material support: Jackson C. Barton, Acton.
Supervision: James C. Barton, Acton.
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Additional Contributions: The following individuals performed data collection (2001-2003) and received compensation for their work: Paul C. Adams, MD (Department of Medicine, London Health Sciences Centre, London, Ontario, Canada); John H. Eckfeldt, MD, PhD (Department of Laboratory Medicine and Pathology, University of Minnesota, Minneapolis); Victor R. Gordeuk, MD (Division of Hematology and Oncology, Department of Medicine, University of Illinois at Chicago, Chicago); Emily Harris, PhD (Epidemiology and Genomics Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, Bethesda, Maryland); Helen Harrison, RN (The Western-Fanshawe Collaborative BScN Program, Fanshawe College, London, Ontario, Canada); Christine E. McLaren, PhD (Department of Epidemiology, University of California, Irvine, California); and Gordon D. McLaren, MD (Division of Hematology/Oncology, Department of Medicine, University of California, Irvine, and Department of Veterans Affairs Long Beach Healthcare System, Long Beach, California).
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SUPPLEMENT 1.

- eTable 1. Prevalences of iron deficiency in 40,381 women aged 25-54 y in the HEIRS Study*
- eTable 2. Relative (fold) prevalences of iron deficiency in 40,381 women aged 25-54 y in the HEIRS Study*
- eTable 3. Prevalences of iron deficiency in 2039 women aged 25-44 y in the HEIRS Study who reported pregnancy*
- eTable 4. Prevalences of iron deficiency in 62,685 women in the HEIRS Study by race/ethnicity*
- eTable 5. Relative (fold) prevalences of iron deficiency in 62,685 women in the HEIRS Study by race/ethnicity*

SUPPLEMENT 2.

Data Sharing Statement