

# Factors Associated with Anemia Based on an Analysis of National Health and Nutrition Examination Survey Data

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## Background

- Anemia is recognized as a health problem with major health consequence worldwide.
- The causes of anemia vary. The major cause is nutritional deficiencies, particularly iron deficiency.<sup>1</sup>
- In Japan, prevalence of anemia is reportedly higher than in other developed countries among women of reproductive age (15–49 years)<sup>2</sup> and older adults.<sup>3</sup>
- To investigate racial differences in anemia, we analyzed National Health and Nutrition Examination Survey (NHANES) database that includes demographic information as well as health and nutritional status based on interviews and physical examinations.

References:

1. Iron deficiency anaemia: assessment, prevention, and control. A guide for programme managers. Geneva, World Health Organization, 2001 (WHO/NHD/01.3). 2001.
2. The global prevalence of anaemia in 2011. In: Organization WH, editor.: World Health Organization; 2015.
3. Imai E, Nakade M. Fish and meat intakes and prevalence of anemia among the Japanese elderly. *Asia Pac J Clin Nutr.* 2019;28(2):276-284.

## Conclusion

- Asian race was associated with higher anemia prevalence compared to white after adjusting for other factors. This may be an indication of the reported higher prevalence of anemia in Japan compared to other developed countries, mainly Western countries.

## Methods

- Data source: NHANES database (2017-March 2020)
  - ✓ Provided as pre-pandemic data: 2019-2020 data collection could not be completed due to COVID-19 pandemic, data from 2019 to March 2020 were combined with data from 2017-2018.
  - ✓ Included 15,560 individuals
  - ✓ Contained demographic data (age, gender, ethnicity, family income, etc.), laboratory data, questionnaire data, examination data, and dietary data
  - ✓ Weights were provided for individuals to produce nationally representative estimate.
- Target population: Individuals aged ≥18 years and had all information used for the analysis (Table 1)
- Definition of anemia: hemoglobin (Hb) levels of ≤13 for men and ≤12 g/dl for women
- Analysis: A logistic regression analysis with anemia (defined as above) as the explained variable and with the factors listed below as the explanatory variables
  - ✓ Age
  - ✓ Gender
  - ✓ Ethnicity: White [reference group], Hispanic, black, Asian, or other race
  - ✓ Income level: A ratio of family income to poverty guidelines
  - ✓ Body mass index (BMI)
  - ✓ Dietary iron intake: Amount of dairy dietary iron intake (average of 2 days):
- Weights (see the last bullet of “Data source” above) were used for the analysis.

## Results and Discussions

- In total 5,836 individuals were identified for the analysis (Table 1).
- Prevalence of anemia was 3.6% in men and 9.5% in women.
- In the logistic regression analysis, Hispanic, black and Asian race was associated with statistically significantly higher anemia rates relative to white race ( $p < 0.01$ ). An increase in age and female gender was associated with statistically significantly higher anemia rates and an increase in income, BMI, and dietary iron intake was associated with statistically significantly lower anemia rates ( $p < 0.01$ ).
  - ✓ The Asian race was associated with higher anemia prevalence than the white race after adjusting for age, gender, income, BMI, and dietary iron intake. This supports the reported higher prevalence of anemia in Japan compared to Western countries.

Table 1. Identification of Target Population

	Criteria	#People	%
1	Initial # people	15,560	100.0%
2	Weight <sup>a</sup> >0	14,300	91.9%
3	Having age/gender	14,300	91.9%
4	Having ethnicity	14,300	91.9%
5	Having family income	12,453	80.0%
6	Having BMI	11,443	73.5%
7	Having Hb	10,259	65.9%
8	Having medical questionnaire	10,245	65.8%
9	Having dietary interview	8,109	52.1%
10	Age ≥18 years	5,836	37.5%

<sup>a</sup>Weight: value provided to produce nationally representative estimate (see Methods)

Table 2. Odds Ratio of Selected Variables to Anemia

Variables	Odds ratio		
	Point Estimates	95% CIs	
		Lower	Upper
Age	1.020	1.020	1.020
Female	2.612	2.608	2.616
Hispanic	1.376	1.374	1.379
Black	4.472	4.465	4.479
Asian	1.602	1.597	1.606
Other race	0.767	0.764	0.770
Income level	0.872	0.871	0.872
BMI	0.997	0.997	0.998
Dietary iron intake	0.995	0.995	0.996

- Limitations
  - ✓ Factors that appear to be associated with anemia were adjusted by including them as explanatory variables; not all factors may be adjusted.
  - ✓ Patients with anemia were defined based on Hb level. Therefore, patients diagnosed with anemia and whose Hb level was controlled were not included.
  - ✓ Reliability of survey data depends on accuracy and credibility of responses. to what extent they accurately understood the questions and to what extent they answered the questions truthfully.
  - ✓ NHANES is designed to ensure external validity, but not necessarily to ensure generalizability.