



# Nutritional Anemia

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# National Anemia Action Council

[www.anemia.org](http://www.anemia.org)

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# NAAC Mission



The National Anemia Action Council, Inc. (NAAC) is dedicated to raising the awareness of health care professionals and the public regarding the prevalence, symptoms, consequences, and treatment options of anemia.

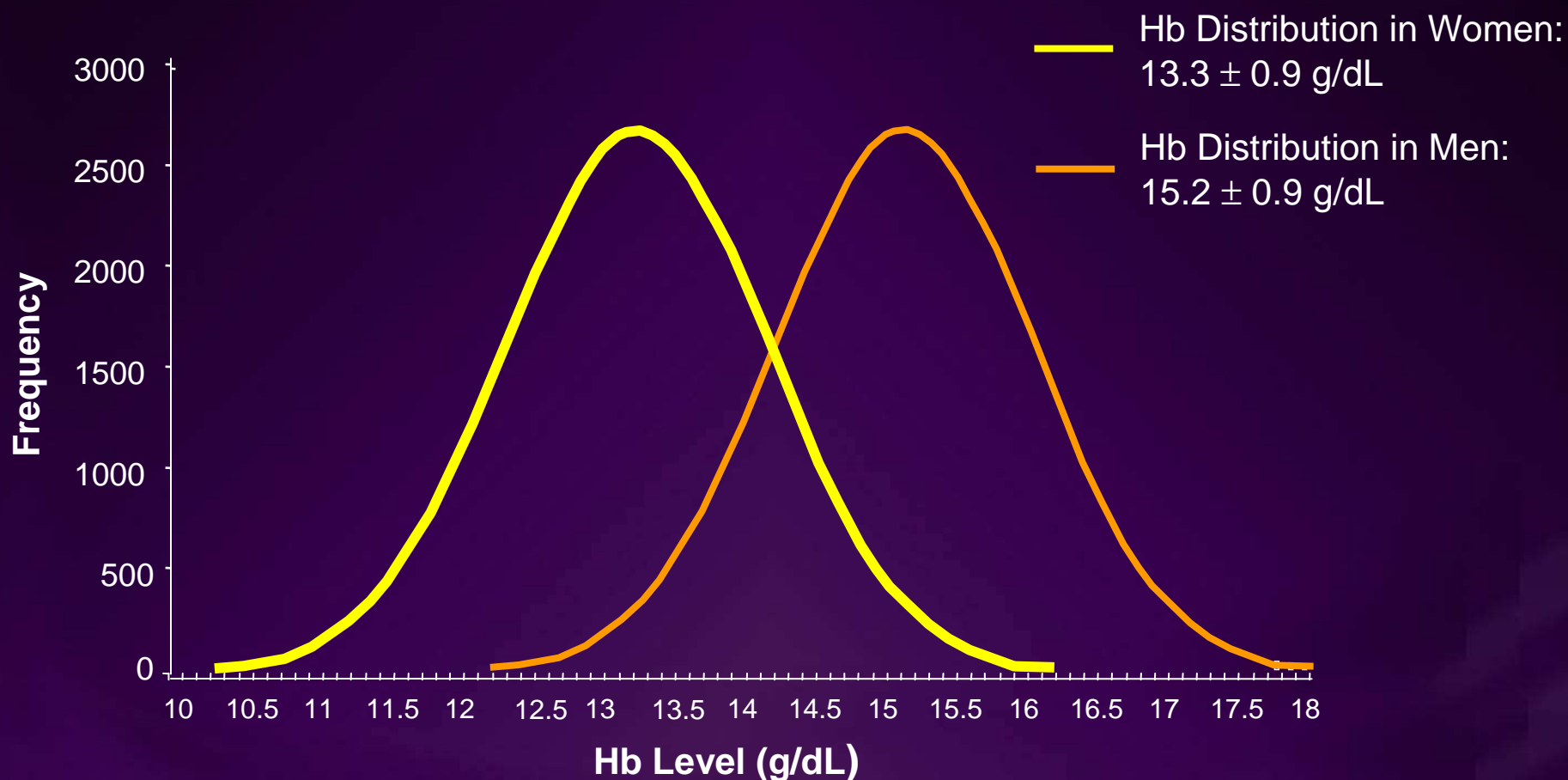
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# NAAC's Online Resources for Medical Professionals



- Research Reviews - Recent clinical trials reviewed
- Ask the Expert - Your anemia questions answered
- Monograph - In-office handbook on anemia
- Feature Articles - Anemia related news and research
- Anemia Alert - Free monthly e-newsletter
- Slide Sets - Educational presentations about anemia
- We have materials for your patients too!

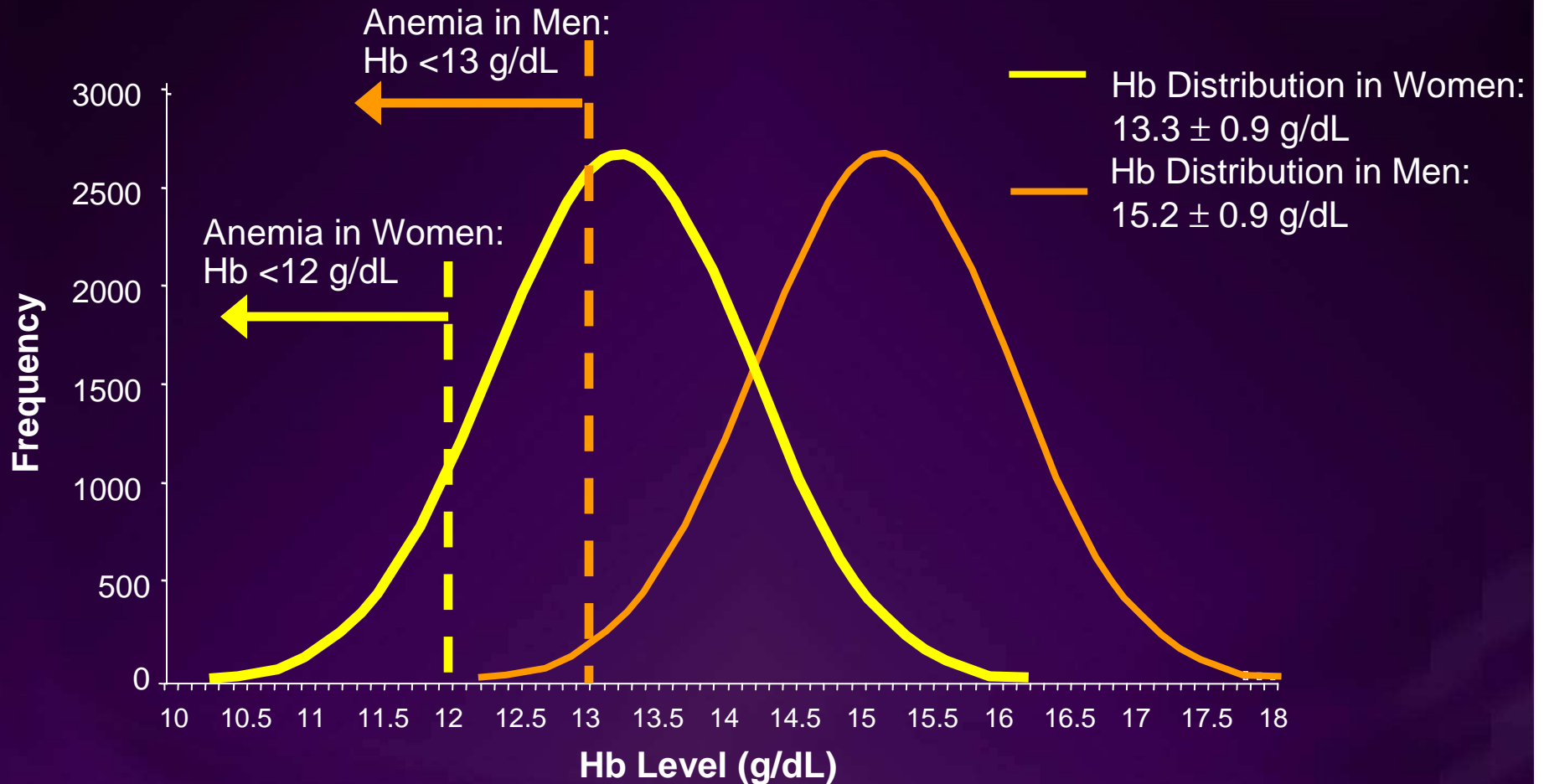
# Hemoglobin (Hb) Distribution in the General Population



N=40,000 (NHANES III, 1988-1994)

Dallman PR, et al. In: *Iron Nutrition in Health and Disease*. London, UK: John Libbey & Co; 1996:65-74

# WHO Definition of Anemia vs Hb Distribution General Population



N=40,000 (NHANES III, 1988-1994)

1. World Health Organization. Geneva, Switzerland; 2001
2. Dallman PR, et al. In: *Iron Nutrition in Health and Disease*. London, UK: John Libbey & Co; 1996:65-74

# Laboratory Reference Ranges



Parameter	Male	Female
Hb (g/dL)	14.0 – 17.4	12.3 – 15.3
Hct (%)	41.5 – 50.4	36.0 – 45.0
RBC count ( $10^6/\mu\text{L}$ )	4.5 – 5.9	4.5 – 5.1
Reticulocyte count (% of RBC count)	0.5 – 2.5	
Mean corpuscular volume (fL)	80 – 96	
Mean corpuscular Hb (MCH) (pg)	27.5 – 33.2	
MCH concentration (g/dL)	33.4 – 35.5	

Hb = hemoglobin; Hct = hematocrit; RBC = red blood cell

Perkins S. In: Lee G, et al, eds. *Wintrobe's Clinical Hematology (Vol. 2)*. 10th ed. Baltimore, Md: Lippincott, Williams & Wilkins; 1998:2738

# Key Points

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- Prevalence and etiology of nutritional anemia
- Effects of nutritional anemia on health and well-being
- Treatment for nutritional anemia

# Nutritional Anemia: Etiology

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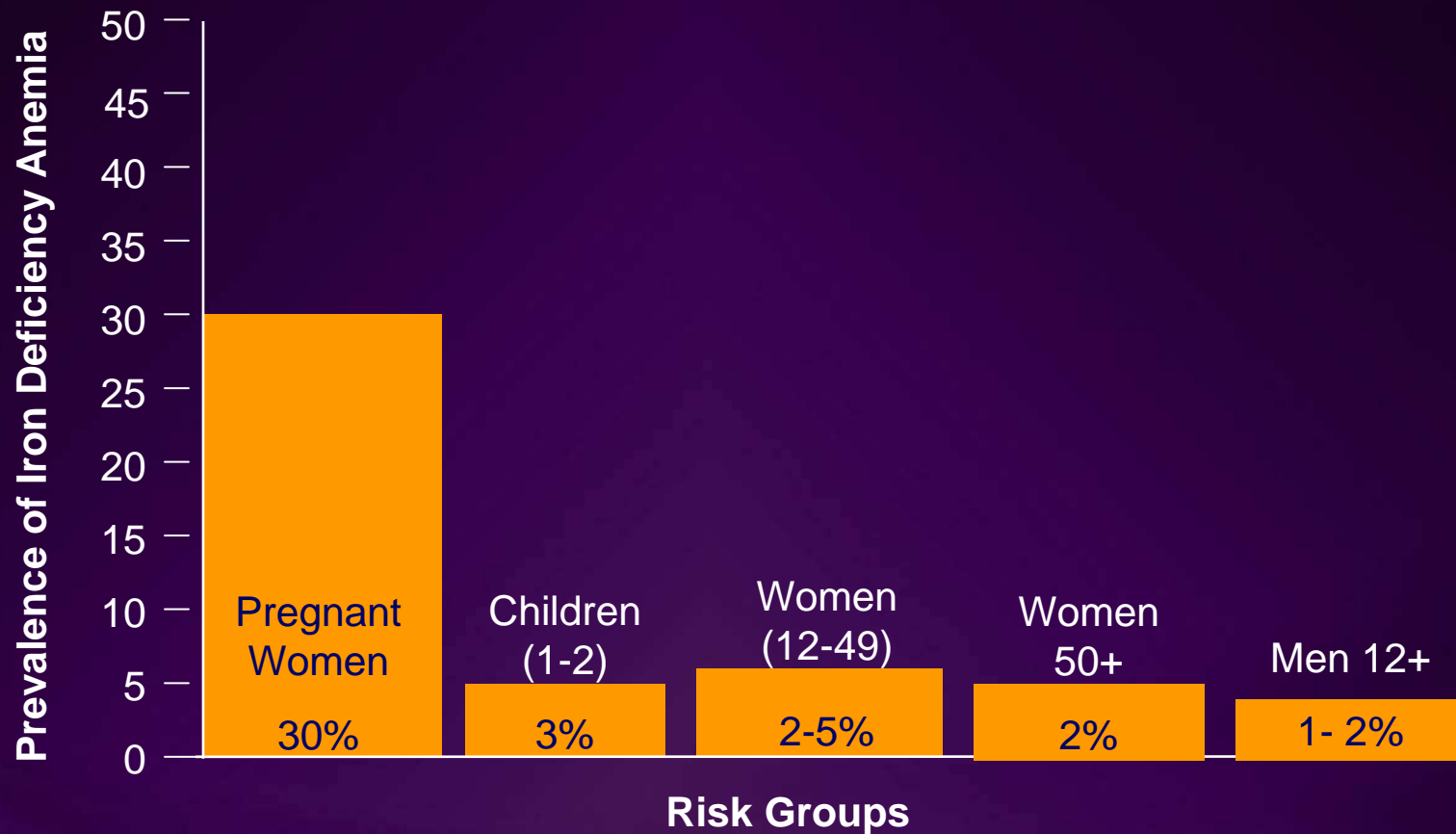
Nutritional anemia arises from inadequate intake or malabsorption of food for any reason.



# Nutritional Anemia

Iron Deficiency: Pathophysiology

# Iron Deficiency: The Most Common Nutritional Cause for Anemia



Looker AC et al. JAMA. 1997;277:973

# Definition: Iron Deficiency Anemia (IDA)

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- Iron deficiency is defined as a decreased total iron body content
- When iron deficiency is severe enough to diminish erythropoiesis, iron deficiency anemia develops

# Causes of Iron Deficiency



- Too little iron in diet
- Poor iron absorption (Celiac disease; Helicobacter pylori)
- Chronic blood loss
- Expanding red blood cell mass during pregnancy

**90%** of IDA is linked to excessive blood loss due to menses or pregnancy. GI-related iron deficiency is more often related to malabsorption in young women. Iron deficiency in men occurs most commonly due to GI blood loss.

Medline Plus at: <http://www.nlm.nih.gov/medlineplus/ency/article/000584.htm>

# IDA Laboratory Workup



- CBC
  - Chronic IDA red cell indices are microcytic and hypochromic (MCV and MCHC below normal range)
    - Reference range values: MCV 83-97 fl; MCHC 32-36 g/dL
  - The platelet count may be elevated ( $>450,000/\text{mm}^3$ )
- Serum Ferritin
- Transferrin Saturation
- Total Iron Binding Capacity
- Serum Iron



# Nutritional Anemia

Vitamin B12 (Cobalamin) Deficiency

# Vitamin B12 Deficiency Prevalence



25% of institutionalized elderly people and 12% to 14% of community-dwelling adults over the age of 60 years are estimated to have low vitamin B12 stores

1. Kuzminski AM, et al. Blood 1998;92:1191-8
2. Krasinski SD, et al. J Am Geriatr Soc 1986;34:800-6

# Differentiating Between Pernicious Anemia and Other Forms of Vitamin B12 Deficiency



- Pernicious anemia is caused by failure of gastric parietal cells to produce sufficient intrinsic factor (IF) for vitamin B12 absorption due to their destruction by antibodies
- Vitamin B12 deficiency can result from pernicious anemia, achlorhydria due to decreased iron stores, or other disorders leading to reduced cobalamin intake or absorption

# Vitamin B12 Absorption Physiology



- Dietary cobalamin (Cbl) is acquired primarily from meat and milk
  - Proteolytic enzymes release Cbl from food
  - Cbl binds to IF (becomes an IF-Cbl complex) which is absorbed in the terminal small bowel
  - Ileal receptors recognize IF-Cbl complex and transport the Cbl into the blood
  - The Cbl blood transporter is transcobalamin II
- Any malfunction in above steps can lead to B12 deficiency

# Causes of Vitamin B12 Deficiency



- Atrophic gastritis and pernicious anemia are the most common causes of vitamin B12 deficiency in older patients<sup>1</sup>
- Gastrectomy
- Histamine 2 (H2) blockers, ingestion of caustic materials or hypochlorhydria from any cause
- Inadequate proteolysis of dietary cobalamin
- Insufficiency of pancreatic proteases
- Bacterial overgrowth in intestine
- Ileal mucosal disorders (sprue, ileitis, etc.)
- Fish tapeworm

1. Kuzminski AM, et al. Blood 1998;92:1191-8

# Laboratory Workup Vitamin B12 Deficiency



- Peripheral blood
  - Macrocytic anemia with mild leukopenia and thrombocytopenia
    - MCV increased; MCHC increased
    - Leukopenia and thrombocytopenia parallel severity of the anemia
  - Peripheral smear
    - Oval macrocytes, hypersegmented granulocytes, anisopoikilocytosis of the red cells
    - B12 deficiency and Folate deficiency blood smears look exactly alike.



# Nutritional Anemia

Folic Acid Deficiency

# Folic Acid Deficiency



- One of the most common vitamin deficiencies in the U.S.
  - Associated with excessive alcohol intake
    - Affecting 5% of U.S. population
  - Associated with pregnancy
    - 20% are folate-deficient
  - Occurs with decreased intake, malabsorption syndromes and with increased demand (hemolytic anemia or exfoliative dermatitis)

# Factors Related to Folic Acid Deficiency



- Associated with elevated serum homocysteine
  - Leads to increased risk for arteriosclerosis
- Increased incidence of neural tube defects without folate supplementation during pregnancy



# Treating Nutritional Anemia

Iron Deficiency Anemia

# Optimal Therapeutic Regimen



- The Centers for Disease Control (CDC) recommends three months of iron supplementation for adults with iron deficiency anemia
- Oral iron supplementation may result in normal hemoglobin levels after a few weeks; however, iron stores will not be replenished without an extended course of iron supplementation
- Parenteral iron supplementation is available

# Dietary Iron



- The body absorbs iron best from ingestion of meat.
- Absorption can be increased by adjunct ingestion of the following:
  - Oral vitamin C supplementation
  - Foods high in vitamin C
  - Oral iron supplementation
- Iron absorption can be blocked by coffee, tea, egg yolks, milk, fiber, spinach and soy protein



# Treating Nutritional Anemia

Vitamin B12 Deficiency

# Vitamin B12 Deficiency Dietary Therapy



- Individuals with abnormal B12 absorption but without pernicious anemia may benefit from dietary supplementation
  - Meat
  - Eggs
  - Milk
  - Dietary supplement

# Vitamin B12 Deficiency Pernicious Anemia



- Individuals with B12 deficiency due to pernicious anemia usually must receive intramuscular injections of vitamin B12
- Subcutaneous injections are available for patients with contraindications to intramuscular injections
- Vitamin B12 comes in pills large enough to get some absorption by mass action



# Treating Nutritional Anemia

Folic Acid Deficiency

# Treating Folic Acid Deficiency



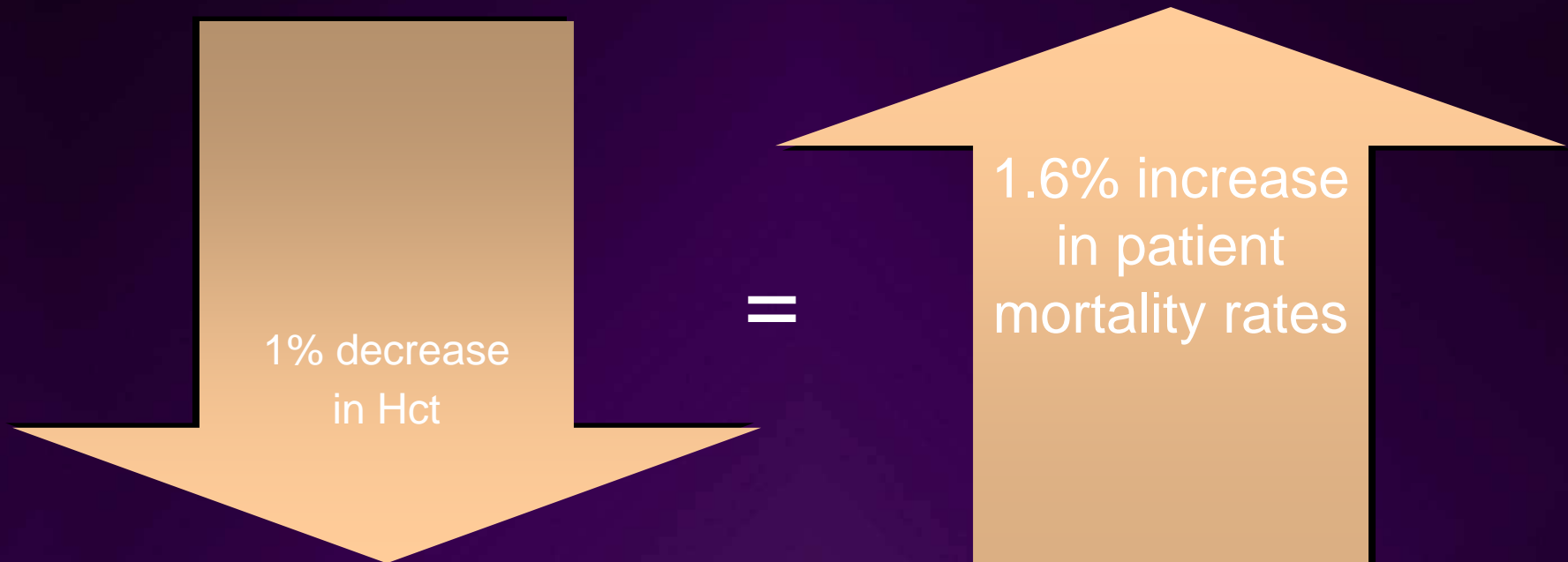
- Individuals with folic acid deficiency usually benefit from oral folic acid supplementation
- Additional benefits can be obtained through dietary supplementation
  - Lightly cooked greens
  - Citrus foods



# Anemia

Health and Well-Being

# Anemia as an Independent Factor



Anemia is associated independently with increased mortality and morbidity

McClellan et al. J Am Soc Nephrol, 2002;3:1928

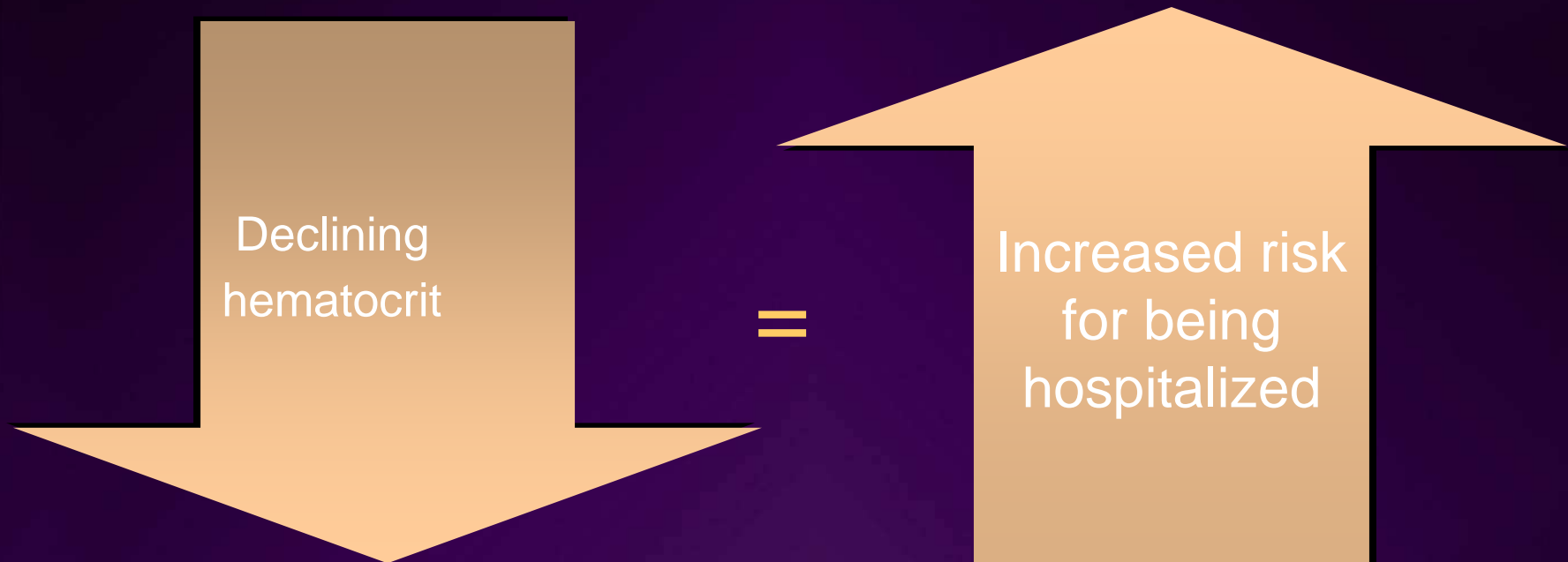
# Results of Izaks, et al 1999



- A study of 872 people over the age of 85 studied hemoglobin concentration, 10-year survival, and primary cause of death
  - Mortality risk was 1.60% in women with anemia
  - Mortality risk was 2.29% in men with anemia
  - Anemia was associated with increased risk of mortality in people over 85

Izaks, GJ, et al. JAMA. 1999;281:1714

# Association Between Anemia and Risk of Hospitalization



Besarab, et al studied patients with end-stage renal disease and found their risk for hospitalization increased as their hematocrit levels declined

Besarab, et al. 1998. N Engl J Med. 1998;339:584

# Anemia and Physical Functioning



- Results of Herndon et al
  - Population-based case-control study evaluating chronic medical conditions and the risk of fall injury events in patients over 65 in the general community (467 cases and 691 control subjects)
  - Persons with a history of anemia had an increased risk of a fall injury event; for anemia the adjusted odds ratio equaled 1.5
- Conclusion: People over the age of 65 with anemia were at increased risk of a fall injury event in the home

Herndon JG et al. Am Geriatr Soc, 1997;45:739

# Summary



- Appropriate workup and identification, of anemia are required to insure the correct treatment
- Nutritional anemia can significantly impact patient quality of life
- Correction of anemia may decrease patient mortality and morbidity

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