



HEMOGLOBIN REFERENCE RANGE AND PREVALENCE OF ANEMIA IN URBAN/SUBURBAN MINNESOTA

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MLSP 6905 Capstone Project Presentation

Project Research Purpose

- Calculate population-specific hemoglobin reference ranges in an urban/suburban Minnesota population
- Evaluate the appropriateness of World Health Organization guidelines for the diagnosis of anemia in this population

Background

- Anemia: decrease in blood's oxygen carrying capacity
 - Evaluated using hemoglobin (Hgb) concentration
- At high altitudes, Hgb increases
 - Natural variations in response to altitude exist
 - WHO corrections can lead to overdiagnosis
- Negative implications of misdiagnosis
- Population-specific approach may be more accurate

Materials & Methods

Calculated Reference Ranges

- Otherwise healthy individuals

- Grouped according to age and gender
 - 5-11: M/F
 - 12-21: M, F
 - 22-49: M, F
 - 50+: M, F

- Reference Range=Mean \pm 2SD

Results: Calculated Hemoglobin Reference Ranges for Urban/Suburban Minnesota

Age (years)	Gender	n	Mean Hgb (g/dL)	SD	Reference Range (Mean \pm 2SD)
5-11	M, F	72	12.0	0.95	10.1-13.9
12-21	M	48	13.3	1.33	10.6-16.0
	F	46	12.8	1.02	10.8-14.9
22-49	M	49	15.4	1.14	13.1-17.7
	F	49	13.1	1.02	11.1-15.1
50+	M	50	15.1	0.80	13.5-16.7
	F	50	13.4	0.92	11.6-15.3

Materials & Methods

Frequency of Anemia

- 39,942 total patients
 - ≥ 5 years old
 - 2005-2018
 - Did not meet exclusion criteria
- Patients with low Hgb identified
 - Grouped by age and gender
- Frequency = $\frac{\text{anemic patients}}{\text{total patients}}$

Exclusion Criteria

Inpatients
>90 years old
Celiac disease
Ulcerative colitis
Diverticulitis
Autoimmune disorders
Myocardial infarction
Congestive heart failure
Peripheral vascular disease
CVA or TIA
Dementia
COPD
Connective tissue disease
Peptic ulcer disease
Liver disease
Diabetes
Hemiplegia
Chronic kidney disease
Solid tumor
Leukemia
Lymphoma
AIDS

Results: Hemoglobin Cutoff Values for the Diagnosis of Anemia

Age (years)	Gender	Calculated Cutoff (g/dL)	Established Cutoff (g/dL)	WHO Cutoff (g/dL)
5-11	M/F	<10.1	<10.5, <10.6, <11.1, <11.5, <13	<11.5
12-21	M	<10.6	<10.5, <11.2, <11.5, <11.7, <13, <13.3, <14	12 years: <11.5 13-21 years: <13.0
	F	<10.5	<10.5, <11.2, <11.7, <11.5, <12	12 years: <11.5 13-21 years: <12.0
22-49	M	<13.1	<11.7, <13.3, <14	<13.0
	F	<11.1	<11.7, <12, <13.3	<12.0
50+	M	<13.5	<13.3, <14	<13.0
	F	<11.6	<11.7, <12, <13.3	<12.0

Results: Frequency of Anemia (per 1,000)

Age (years)	Gender	Calculated Cutoff	Established Cutoff	WHO Cutoff
5-11	M/F	49.8	473.5	≥472.0*
12-21	M	161.6	276.1	≥272.7*
	F	88.8	225.6	≥225.6*
22-49	M	93.2	144.5	≥76.5*
	F	47.7	117.2	≥117.2*
50+	M	32.3	32.9	20.5
	F	50.2	57.5	≥57.4*

* Incomplete data prevented accurate calculation of WHO frequencies in these groups

Conclusion

Using hemoglobin cutoff values that are specific for a given population provides a more accurate picture of anemia prevalence than WHO guidelines

Study Limitations / Next Steps

Limitations

- Incomplete dataset
- Variations in established reference ranges

Next Steps

- Repeat frequencies with full dataset
- Evaluate causes of anemia within this population
- Evaluate appropriateness of WHO reference ranges in other populations

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Questions?