**Testing Updates Newsletter – December 2021**

**Updates Effective Immediately or December 6th**

|  |  |  |  |
| --- | --- | --- | --- |
| **SUMMARY OF CHANGES** | | | |
| **ORDER CODE** | **TEST NAME** | **CHANGE TYPE** | **DATE EFFECTIVE** |
| *[ANEMP](#Anchor1)* | Anemia Panel | Reference Interval, Result Code(s) | December 6, 2021 |
| *[CBC\_MD](#Anchor2)* | CBC With Manual Differential | Reference Interval, Specimen Requirements, Test Name | December 6, 2021 |
| *[CBC\_NOD](#Anchor3)* | CBC Without Differential (Hemogram) | Reference Interval, Specimen Requirements | December 6, 2021 |
| *[HLA\_DQ](#Anchor4)* | Celiac Disease (HLA-DQ2, and HLA-DQ8)  Genotyping | Inactive | December 6, 2021 |
| *[HLA\_DQ\_G](#Anchor5)* | Celiac Disease HLA-DQ Genotyping | New Test | December 6, 2021 |
| *[CBC](#Anchor6)* | Complete Blood Count (CBC) w/Automated Diff | Reference Interval, Result Code(s), Specimen Requirements | December 6, 2021 |
| *[COVID19](#Anchor7)* | COVID-19 (SARS-CoV-2 RNA) by PCR | Specimen Requirements | Immediately |
| *[GEN\_H](#Anchor8)* | General Health Panel (CMP, CBC, TSH) | Reference Interval, Result Code(s) | December 6, 2021 |
| *[HM4](#Anchor9)* | Heavy Metals Panel 4 (Arsenic, Cadmium, Mercury, and Lead), Whole Blood | Reference Interval | December 6, 2021 |
| *[H\_H](#Anchor10)* | Hemoglobin and Hematocrit | Reference Interval, Specimen Requirements | December 6, 2021 |
| *[HGB](#Anchor11)* | HGB (Hemoglobin, Whole Blood) | Reference Interval, Specimen Requirements | December 6, 2021 |
| *[HYP\_COAG](#Anchor12)* | Hypercoagulation Panel | Reference Interval, Result Code(s) | December 6, 2021 |
| *[LEAD\_C](#Anchor13)* | Lead, Blood (Capillary) | Reference Interval, Interpretive Data | December 6, 2021 |
| *[LEAD\_OCC](#Anchor14)* | Lead, Industrial Exposure Panel in Whole Blood, Adults | Reference Interval, Interpretive Data | December 6, 2021 |
| *[LEAD](#Anchor15)* | Lead, Whole Blood (Venous) | Reference Interval, Interpretive Data | December 6, 2021 |
| *[LIPA](#LIPA)* | Lipoprotein (a), Serum or Plasma | Performing Laboratory, Specimen Requirements | Immediately |
| *[OBS\_PRO](#Anchor16)* | Obstetric Panel (ABORH, RCB AB, HEP B, RUB, CBC, TREP) | Reference Interval, Result Code(s) | December 6, 2021 |
| *[RBC](#Anchor17)* | RBC (Red Blood Cell Count) | Reference Interval, Specimen Requirements | December 6, 2021 |
| *[WBC](#Anchor18)* | WBC (White Blood Cell Count) | Reference Interval, Specimen Requirements | December 6, 2021 |

|  |
| --- |
| **TEST DETAILS** |

[*ANEMP*](#TA1) **Anemia Panel**

**Result Codes**:

14685-2 Vitamin B12 (Cobalamin), Serum or Plasma

20567-4 Ferritin, Serum or Plasma

2284-8 Folate (Folic Acid), Serum or Plasma

60474-4 Reticulocytes #

17849-1 Reticulocyte %

2498-4 Iron, Serum or Plasma

2501-5 UIBC (Unsaturated Iron Binding Capacity)

2500-7 TIBC (Total Iron Binding Capacity), Calculation

2502-3 Transferrin Saturation (Calc)

6690-2 WBC (White Blood Cell Count)

789-8 RBC (Red Blood Cell Count)

718-7 HGB (Hemoglobin, Whole Blood)

4544-3 HCT (Hematocrit)

787-2 MCV (Mean Cell Volume)

785-6 MCH (Mean Cell Hemoglobin)

786-4 MCHC (Mean Cell Hb Conc)

21000-5 RDW (Red Cell Dist Width)

777-3 PLT (Platelet Count), Whole Blood

32623-1 MPV (Mean Platelet Volume)

770-8 NEUT%

736-9 LYMPH%

5905-5 MONO%

713-8 EOS%

706-2 BASO%

71695-1 IG% New Component

751-8 NEUT#

731-0 LYMPH#

742-7 MONO#

711-2 EOS#

704-7 BASO#

53115-2 IG# New Component

**Updated Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

NEUT%

Age Female Parameter Male Parameter Units

< 2 years 14.6-69.3 14.6-69.3 %

2-12 years 33.6-77.5 23.0-76.7 %

12-21 years 39.6-80.0 33.0-80.0 %

> 21 years 34.0-71.1 34.0-67.9 %

LYMPH%

Age Female Parameter Male Parameter Units

< 2 years 8.0-70.0 8.0-70.0 %

2-12 years 10.0-59.0 8.0-65.0 %

12-21 years 8.0-52.8 8.0-45.8 %

> 21 years 19.3-51.7 21.8-53.1 %

MONO%

Age Female Parameter Male Parameter Units

< 2 years 4.0-19.0 4.0-19.0 %

2-12 years 4.0-12.5 3.0-9.0 %

12-21 years 2.7-12.5 3.0-9.2 %

> 21 years 4.7-12.5 5.3-12.2 %

EOS%

Age Female Parameter Male Parameter Units

< 2 years 1.0-7.0 1.0-7.0 %

2-12 years 1.0-4.0 0.0-5.0 %

12-21 years 0.5-7.2 0.0-6.2 %

> 21 years 0.7-5.8 0.8-7.0 %

BASO%

Age Female Parameter Male Parameter Units

< 2 years 0.0-1.0 0.0-1.0 %

2-12 years 0.0-1.0 0.0-1.0 %

12-21 years 0.0-1.0 0.0-1.3 %

> 21 years 0.1-1.2 0.2-1.2 %

IG%

Age Female Parameter Male Parameter Units

< 2 years 0.00-1.70 0.00-1.70 %

2-12 years 0.19-0.24 0.19-0.24 %

12-21 years 0.19-0.24 0.19-0.24 %

> 21 years 0.19-0.24 0.19-0.24 %

NEUT#

Age Female Parameter Male Parameter Units

< 2 years 2.20-11.40 2.20-11.40 x 103/μL

2-12 years 1.50-8.64 1.50-8.50 x 103/μL

12-21 years 1.90-8.64 1.92-8.64 x 103/μL

> 21 years 1.56-6.13 1.78-5.38 x 103/μL

LYMPH#

Age Female Parameter Male Parameter Units

< 2 years 1.20-5.70 1.20-5.70 x 103/μL

2-12 years 0.96-7.29 0.96-7.29 x 103/μL

12-21 years 0.40-3.90 0.40-3.90 x 103/μL

> 21 years 1.18-3.74 1.32-3.57 x 103/μL

MONO#

Age Female Parameter Male Parameter Units

< 2 years 0.10-5.00 0.10-5.00 x 103/μL

2-12 years 0.00-1.20 0.00-1.20 x 103/μL

12-21 years 0.20-0.90 0.20-1.30 x 103/μL

> 21 years 0.24-0.36 0.30-0.82 x 103/μL

EOS#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.50 0.00-0.50 x 103/μL

2-12 years 0.00-0.50 0.00-0.50 x 103/μL

12-21 years 0.00-0.40 0.00-0.40 x 103/μL

> 21 years 0.04-0.36 0.04-0.54 x 103/μL

BASO#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.10 0.00-0.10 x 103/μL

2-12 years 0.00-2.80 0.00-2.27 x 103/μL

12-21 years 0.00-0.10 0.00-0.10 x 103/μL

> 21 years 0.01-0.08 0.01-0.08 x 103/μL

IG#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.28 0.00-0.28 x 103/μL

2-12 years 0.01-0.02 0.01-0.02 x 103/μL

12-21 years 0.01-0.02 0.01-0.02 x 103/μL

> 21 years 0.01-0.02 0.01-0.02 x 103/μL

*[CBC\_MD](#TA2)* **CBC With Manual Differential**

NAME UPDATED – Previously *CBC W/ Manual Differential*

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

*[CBC\_NOD](#TA3)* **CBC Without Differential (Hemogram)**

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

*[HLA\_DQ](#TA4)* **Celiac Disease (HLA-DQ2, and HLA-DQ8) Genotyping**

INACTIVE – Refer to *Celiac Disease HLA-DQ Genotyping* (HLA\_DQ\_G)

*[HLA\_DQ\_G](#TA5)* **Celiac Disease HLA-DQ Genotyping**

NEW TEST

**Performing Laboratory**: Histocompatibility& Immunogenetics Laboratory, University of Utah Health, 417 Wakara Way, Suite 3220, Salt Lake City, UT 84108.Counseling and informed consent are recommended for genetic testing. Consent forms are available online.

**Methodology:** Polymerase Chain Reaction/Massively Parallel Sequencing, or Polymerase Chain Reaction/Sequence-Specific Oligonucleotide Probe Hybridization

**Specimen Requirements:**

**Preferred Container:** Lavender (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. (Min: 1 mL)**Unacceptable:** Specimens collected in Yellow (ACD Solution B). Clotted, grossly hemolyzed, or heparinized specimens.

**Stability**: Ambient: 72 hours; Refrigerated: 1 week; Frozen: Unacceptable

**Reference Interval:** By report

**Result Codes:**

59019-0 HLA-DQA1, Allele 1

59019-0.2 HLA-DQA1, Allele 2

57299-0 HLA-DQB1, Allele 1

57299-0.2 HLA-DQB1, Allele 2

48767-8 Celiac HLA Interpretation

**Interpretive Data:**

**Background Information for Celiac Disease HLA-DQ Genotyping:**

**Characteristics:** Celiac disease is a systemic autoimmune disease of the gastrointestinal system caused by exposure to cereal gluten in genetically susceptible individuals.

**Incidence:** On average, 1 in 133 individuals in the United States is affected.

**Inheritance:** Multifactorial.

**Cause:** The presence of either HLA-DQ2 or the HLA-DQ8 alleles in combination with dietary gluten.

**Clinical Sensitivity:** greater than 99 percent.

**Methodology:** Polymerase Chain Reaction/Massively Parallel Sequencing, or Polymerase Chain Reaction/Sequence-Specific Oligonucleotide Probe Hybridization.

**Analytical Sensitivity and Specificity:** greater than 99 percent.

**Limitations:** Rare diagnostic errors may occur due to primer site mutations. Other genetic and nongenetic factors that influence celiac disease are not evaluated. In cases where an HLA allele cannot be resolved unambiguously, the allele assignment will be reported as the most common, based on allele frequencies from the common, intermediate and well-documented alleles catalogue version 3.0.0 (Hurley CK et al, 2020).

**Alleles tested:** HLA-DQA1 and HLA-DQB1 alleles.

Most celiac disease patients (approximately 90 percent) carry HLA-DQ2.5 heterodimers encoded by HLA-DQA1\*05 and HLA-DQB1\*02 alleles. The remaining 5-10 percent of the patients carry HLA-DQ8, encoded by HLA-DQB1\*03:02 allele, most commonly in combination with HLA-DQA1\*03 alleles. A minority of patients negative for the above genotypes may carry HLA-DQB1\*02 but without the DQA1\*05 alpha chain, most commonly with DQA1\*02. The presence of the DQB1\*02 allele in combination with either DQ2.5 or DQ8 may further increase celiac disease risk.

Stratified overall genetic risk for patients carrying the celiac disease-associated HLA-DQ genotypes:  
Genotype Risk\*

DQ2.5 homozygous Very High (greater than 1:10)

DQ2.5 + DQB1\*02 Very High (greater than 1:10)

DQ2.5 + DQ8 High (greater than 1:20)

DQ8 homozygous High (greater than 1:20)

DQ8 + DQB1\*02 (without DQA1\*05) Intermediate (greater than 1:50)

DQ2.5 heterozygous Intermediate (greater than 1:50)

DQ8 heterozygous At risk (greater than 1:100)

Population risk for unknown genotype 1:100

DQB1\*02 (without DQA1\*05) Low

DQA1\*05 (without DQB1\*02) Minimal

Negative for DQ2 and DQ8 Not at risk

\* Risk is provided from the references below, and defined according to HLA allele combinations, considering a disease prevalence of 1:100. However, these alleles are common in the general population and the majority of individuals positive for celiac-associated alleles do not develop the disease. Detection of these alleles can support a clinical diagnosis but should not be interpreted as diagnostic of celiac disease.

References:

1. Megiorni F, Mora B, Bonamico M, et al. HLA-DQ and risk gradient for celiac disease. Human Immunology. 2009;70:55-59.

2. Pietzak MM, Schofield TC, McGinnis MJ, et al. Stratifying risk for celiac disease in a large at-risk United States population by using HLA alleles. Clinical Gastroenterology and Hepatology. 2009;7:966-971.

3. Almeida LM, Gandolfi L, Pratesi R, et al. Presence of DQ2.2 associated with DQ2.5 increases the risk for celiac disease. Autoimmune Diseases, 2016. 2016:5409653.

4. Vader W, Stepniak D, Kooy Y, et al. The HLA-DQ2 gene dose effect in celiac disease is directly related to the magnitude and breadth of glutenspecific T cell responses. PNAS. 2003;100:12390-12395.

**Disclaimer Information:**

This test was developed and its performance characteristics determined by the Histocompatibility& Immunogenetics laboratory at the University of Utah Health. It has not been cleared or approved by the US Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. This test is used for clinical purposes. It should not be regarded as investigational or for research. Histocompatibility& Immunogenetics

laboratory is certified under the Clinical Laboratory Improvement Amendments of 1988 (CLIA-88) as qualified to perform high complexity clinical laboratory testing.

Performed at Histocompatibility& Immunogenetics Laboratory, University of Utah Health, 417 Wakara Way, Suite 3220, Salt Lake City, UT 84108.Counseling and informed consent are recommended for genetic testing. Consent forms are available online.

**CPT Code(s):** 81382 x2

*[CBC](#TA6)*  **Complete Blood Count (CBC) w/Automated Diff**

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Result Codes**:

6690-2 WBC (White Blood Cell Count)

789-8 RBC (Red Blood Cell Count)

718-7 HGB (Hemoglobin, Whole Blood)

4544-3 HCT (Hematocrit)

787-2 MCV (Mean Cell Volume)

785-6 MCH (Mean Cell Hemoglobin)

786-4 MCHC (Mean Cell Hb Conc)

21000-5 RDW (Red Cell Dist Width)

777-3 PLT (Platelet Count), Whole Blood

32623-1 MPV (Mean Platelet Volume)

770-8 NEUT%

736-9 LYMPH%

5905-5 MONO%

713-8 EOS%

706-2 BASO%

71695-1 IG% New Component

751-8 NEUT#

731-0 LYMPH#

742-7 MONO#

711-2 EOS#

704-7 BASO#

53115-2 IG# New Component

**Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

NEUT%

Age Female Parameter Male Parameter Units

< 2 years 14.6-69.3 14.6-69.3 %

2-12 years 33.6-77.5 23.0-76.7 %

12-21 years 39.6-80.0 33.0-80.0 %

> 21 years 34.0-71.1 34.0-67.9 %

LYMPH%

Age Female Parameter Male Parameter Units

< 2 years 8.0-70.0 8.0-70.0 %

2-12 years 10.0-59.0 8.0-65.0 %

12-21 years 8.0-52.8 8.0-45.8 %

> 21 years 19.3-51.7 21.8-53.1 %

MONO%

Age Female Parameter Male Parameter Units

< 2 years 4.0-19.0 4.0-19.0 %

2-12 years 4.0-12.5 3.0-9.0 %

12-21 years 2.7-12.5 3.0-9.2 %

> 21 years 4.7-12.5 5.3-12.2 %

EOS%

Age Female Parameter Male Parameter Units

< 2 years 1.0-7.0 1.0-7.0 %

2-12 years 1.0-4.0 0.0-5.0 %

12-21 years 0.5-7.2 0.0-6.2 %

> 21 years 0.7-5.8 0.8-7.0 %

BASO%

Age Female Parameter Male Parameter Units

< 2 years 0.0-1.0 0.0-1.0 %

2-12 years 0.0-1.0 0.0-1.0 %

12-21 years 0.0-1.0 0.0-1.3 %

> 21 years 0.1-1.2 0.2-1.2 %

IG%

Age Female Parameter Male Parameter Units

< 2 years 0.00-1.70 0.00-1.70 %

2-12 years 0.19-0.24 0.19-0.24 %

12-21 years 0.19-0.24 0.19-0.24 %

> 21 years 0.19-0.24 0.19-0.24 %

NEUT#

Age Female Parameter Male Parameter Units

< 2 years 2.20-11.40 2.20-11.40 x 103/μL

2-12 years 1.50-8.64 1.50-8.50 x 103/μL

12-21 years 1.90-8.64 1.92-8.64 x 103/μL

> 21 years 1.56-6.13 1.78-5.38 x 103/μL

LYMPH#

Age Female Parameter Male Parameter Units

< 2 years 1.20-5.70 1.20-5.70 x 103/μL

2-12 years 0.96-7.29 0.96-7.29 x 103/μL

12-21 years 0.40-3.90 0.40-3.90 x 103/μL

> 21 years 1.18-3.74 1.32-3.57 x 103/μL

MONO#

Age Female Parameter Male Parameter Units

< 2 years 0.10-5.00 0.10-5.00 x 103/μL

2-12 years 0.00-1.20 0.00-1.20 x 103/μL

12-21 years 0.20-0.90 0.20-1.30 x 103/μL

> 21 years 0.24-0.36 0.30-0.82 x 103/μL

EOS#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.50 0.00-0.50 x 103/μL

2-12 years 0.00-0.50 0.00-0.50 x 103/μL

12-21 years 0.00-0.40 0.00-0.40 x 103/μL

> 21 years 0.04-0.36 0.04-0.54 x 103/μL

BASO#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.10 0.00-0.10 x 103/μL

2-12 years 0.00-2.80 0.00-2.27 x 103/μL

12-21 years 0.00-0.10 0.00-0.10 x 103/μL

> 21 years 0.01-0.08 0.01-0.08 x 103/μL

IG#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.28 0.00-0.28 x 103/μL

2-12 years 0.01-0.02 0.01-0.02 x 103/μL

12-21 years 0.01-0.02 0.01-0.02 x 103/μL

> 21 years 0.01-0.02 0.01-0.02 x 103/μL

*[COVID19](#TA7)* **COVID-19 (SARS-CoV-2 RNA) by PCR**

**Performing Laboratory**: Cole Diagnostics

**Ordering Recommendation:** Intended for the qualitative detection of SARS-CoV-2 RNA in the acute phase of infection.

**Methodology:** Real Time RT-PCR

**Specimen Requirements:**

**Preferred Container:** UTM-RT; Also Acceptable: DNA/RNA Shield, VTM, 0.9% Physiological Saline, or cobas® PCR Media

**Specimen Preparation:**  If using UTM-RT or UVT, collect a nasopharyngeal, oropharyngeal, or nasal swab. If using cobas® PCR Media or 0.9% Physiological Saline, collect a nasal swab.

**Unacceptable:** Improperly sealed/leaking specimens

**Stability**: UTM-RT or UVT: A: 48 hours; R: 48 hours; F(-70°C): Indefinitely; DNA/RNA Shield, 0.9% Physiological Saline: A: Unacceptable; R: 48 hours; F: Unacceptable

*[GEN\_H](#TA8)*  **General Health Panel (CMP, CBC, TSH)**

**Result Codes**:

11580-8 TSH

2951-2 Sodium, Serum or Plasma

2823-3 Potassium, Serum or Plasma

2075-0 Chloride, Serum or Plasma

2028-9 CO2 (Carbon Dioxide), Serum or Plasma

2345-7 Glucose, Serum or Plasma

3094-0 BUN (Blood Urea Nitrogen), Serum or Plasma

2160-0 Creatinine, Serum or Plasma

48642-3 GFR

48643-1 GFR (African-American)

3097-3 BUN/Creatinine Ratio, Serum

17861-6 Calcium, Serum or Plasma

1920-8 AST (Aspartate Aminotransferase), Serum or Plasma

1742-6 ALT (SGPT), Serum or Plasma

6768-6 Alkaline Phosphatase

1975-2 Bilirubin Total, Serum or Plasma

2885-2 Protein, Serum or Plasma

1751-7 Albumin, Serum or Plasma

10834-0 Globulin (Calc.)

1759-0 Albumin/Globulin Ratio (Calc.)

6690-2 WBC (White Blood Cell Count)

789-8 RBC (Red Blood Cell Count)

718-7 HGB (Hemoglobin, Whole Blood)

4544-3 HCT (Hematocrit)

787-2 MCV (Mean Cell Volume)

785-6 MCH (Mean Cell Hemoglobin)

786-4 MCHC (Mean Cell Hb Conc)

21000-5 RDW (Red Cell Dist Width)

777-3 PLT (Platelet Count), Whole Blood

32623-1 MPV (Mean Platelet Volume)

770-8 NEUT%

736-9 LYMPH%

5905-5 MONO%

713-8 EOS%

706-2 BASO%

71695-1 IG% New Component

751-8 NEUT#

731-0 LYMPH#

742-7 MONO#

711-2 EOS#

704-7 BASO#

53115-2 IG# New Component

**Updated Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

NEUT%

Age Female Parameter Male Parameter Units

< 2 years 14.6-69.3 14.6-69.3 %

2-12 years 33.6-77.5 23.0-76.7 %

12-21 years 39.6-80.0 33.0-80.0 %

> 21 years 34.0-71.1 34.0-67.9 %

LYMPH%

Age Female Parameter Male Parameter Units

< 2 years 8.0-70.0 8.0-70.0 %

2-12 years 10.0-59.0 8.0-65.0 %

12-21 years 8.0-52.8 8.0-45.8 %

> 21 years 19.3-51.7 21.8-53.1 %

MONO%

Age Female Parameter Male Parameter Units

< 2 years 4.0-19.0 4.0-19.0 %

2-12 years 4.0-12.5 3.0-9.0 %

12-21 years 2.7-12.5 3.0-9.2 %

> 21 years 4.7-12.5 5.3-12.2 %

EOS%

Age Female Parameter Male Parameter Units

< 2 years 1.0-7.0 1.0-7.0 %

2-12 years 1.0-4.0 0.0-5.0 %

12-21 years 0.5-7.2 0.0-6.2 %

> 21 years 0.7-5.8 0.8-7.0 %

BASO%

Age Female Parameter Male Parameter Units

< 2 years 0.0-1.0 0.0-1.0 %

2-12 years 0.0-1.0 0.0-1.0 %

12-21 years 0.0-1.0 0.0-1.3 %

> 21 years 0.1-1.2 0.2-1.2 %

IG%

Age Female Parameter Male Parameter Units

< 2 years 0.00-1.70 0.00-1.70 %

2-12 years 0.19-0.24 0.19-0.24 %

12-21 years 0.19-0.24 0.19-0.24 %

> 21 years 0.19-0.24 0.19-0.24 %

NEUT#

Age Female Parameter Male Parameter Units

< 2 years 2.20-11.40 2.20-11.40 x 103/μL

2-12 years 1.50-8.64 1.50-8.50 x 103/μL

12-21 years 1.90-8.64 1.92-8.64 x 103/μL

> 21 years 1.56-6.13 1.78-5.38 x 103/μL

LYMPH#

Age Female Parameter Male Parameter Units

< 2 years 1.20-5.70 1.20-5.70 x 103/μL

2-12 years 0.96-7.29 0.96-7.29 x 103/μL

12-21 years 0.40-3.90 0.40-3.90 x 103/μL

> 21 years 1.18-3.74 1.32-3.57 x 103/μL

MONO#

Age Female Parameter Male Parameter Units

< 2 years 0.10-5.00 0.10-5.00 x 103/μL

2-12 years 0.00-1.20 0.00-1.20 x 103/μL

12-21 years 0.20-0.90 0.20-1.30 x 103/μL

> 21 years 0.24-0.36 0.30-0.82 x 103/μL

EOS#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.50 0.00-0.50 x 103/μL

2-12 years 0.00-0.50 0.00-0.50 x 103/μL

12-21 years 0.00-0.40 0.00-0.40 x 103/μL

> 21 years 0.04-0.36 0.04-0.54 x 103/μL

BASO#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.10 0.00-0.10 x 103/μL

2-12 years 0.00-2.80 0.00-2.27 x 103/μL

12-21 years 0.00-0.10 0.00-0.10 x 103/μL

> 21 years 0.01-0.08 0.01-0.08 x 103/μL

IG#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.28 0.00-0.28 x 103/μL

2-12 years 0.01-0.02 0.01-0.02 x 103/μL

12-21 years 0.01-0.02 0.01-0.02 x 103/μL

> 21 years 0.01-0.02 0.01-0.02 x 103/μL

*[HM4](#TA9)*  **Heavy Metals Panel 4 (Arsenic, Cadmium, Mercury, and Lead), Whole Blood**

**Reference Interval:**

Arsenic, Blood

Less than or equal to 12.0 μg/L

Cadmium, Blood

Less than or equal to 5.0 μg/L

Mercury, Whole Blood

Less than or equal to 10.0 μg/L

Lead, Blood (Venous)

Age Reference Interval

0-5 years Less than or equal to 3.4 μg/dL

6 years or above Less than or equal to 4.9 μg/dL

*[H\_H](#TA10)*  **Hemoglobin and Hematocrit**

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Reference Interval:**

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

*[HGB](#TA11)*  **HGB (Hemoglobin, Whole Blood)**

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Reference Interval:**

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

*[HYP\_COAG](#TA12)* **Hypercoagulation Panel**

**Result Codes**:

27812-7 Antithrombin 3 Antigen, Plasma

13590-5 APC Resistance

14979-9 aPTT (Partial Thromboplastin Time, Activated)

3255-7 Fibrinogen, Platelet Poor Plasma

13965-9 Homocysteine, Serum

27819-2 Protein C, Functional

27822-6 Protein S, Functional

5076-5 Cardiolipin IgA Ab

3181-5 Cardiolipin IgG Ab

3182-3 Cardiolipin IgM Ab

31208-2 FACV Specimen

21668-9 Factor V Leiden (F5) R506Q

5902-2 Prothrombin Time (ARUP)

6303-2 dRWT Screen

75513-2 dRWT 1:1 Mix (Reflexive)

50410-0 dRWT Confirmation (Reflexive)

34571-0 PTT-LA Screen (PTT-D)

3243-3 Thrombin Time (Reflexive)

6683-7 Reptilase Time

52123-7 PTT-D Heparin Neutralized (Reflexive)

5946-9 PTT-D 1:1 Mix (Reflexive)

15191-0 Platelet Neutralization (PTT-D, Confirm) (Reflexive)

33930-9 Hexagonal Phospholipid Neutral Reflex

75882-1 Lupus Anticoagulation Interpretation

31208-2.02 Prothrombin (F2) G20210A Specimen

24475-6 Prothrombin (F2) G20210A Variant

6690-2 WBC (White Blood Cell Count)

789-8 RBC (Red Blood Cell Count)

718-7 HGB (Hemoglobin, Whole Blood)

4544-3 HCT (Hematocrit)

787-2 MCV (Mean Cell Volume)

785-6 MCH (Mean Cell Hemoglobin)

786-4 MCHC (Mean Cell Hb Conc)

21000-5 RDW (Red Cell Dist Width)

777-3 PLT (Platelet Count), Whole Blood

32623-1 MPV (Mean Platelet Volume)

770-8 NEUT%

736-9 LYMPH%

5905-5 MONO%

713-8 EOS%

706-2 BASO%

71695-1 IG% New Component

751-8 NEUT#

731-0 LYMPH#

742-7 MONO#

711-2 EOS#

704-7 BASO#

53115-2 IG# New Component

**Updated Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

NEUT%

Age Female Parameter Male Parameter Units

< 2 years 14.6-69.3 14.6-69.3 %

2-12 years 33.6-77.5 23.0-76.7 %

12-21 years 39.6-80.0 33.0-80.0 %

> 21 years 34.0-71.1 34.0-67.9 %

LYMPH%

Age Female Parameter Male Parameter Units

< 2 years 8.0-70.0 8.0-70.0 %

2-12 years 10.0-59.0 8.0-65.0 %

12-21 years 8.0-52.8 8.0-45.8 %

> 21 years 19.3-51.7 21.8-53.1 %

MONO%

Age Female Parameter Male Parameter Units

< 2 years 4.0-19.0 4.0-19.0 %

2-12 years 4.0-12.5 3.0-9.0 %

12-21 years 2.7-12.5 3.0-9.2 %

> 21 years 4.7-12.5 5.3-12.2 %

EOS%

Age Female Parameter Male Parameter Units

< 2 years 1.0-7.0 1.0-7.0 %

2-12 years 1.0-4.0 0.0-5.0 %

12-21 years 0.5-7.2 0.0-6.2 %

> 21 years 0.7-5.8 0.8-7.0 %

BASO%

Age Female Parameter Male Parameter Units

< 2 years 0.0-1.0 0.0-1.0 %

2-12 years 0.0-1.0 0.0-1.0 %

12-21 years 0.0-1.0 0.0-1.3 %

> 21 years 0.1-1.2 0.2-1.2 %

IG%

Age Female Parameter Male Parameter Units

< 2 years 0.00-1.70 0.00-1.70 %

2-12 years 0.19-0.24 0.19-0.24 %

12-21 years 0.19-0.24 0.19-0.24 %

> 21 years 0.19-0.24 0.19-0.24 %

NEUT#

Age Female Parameter Male Parameter Units

< 2 years 2.20-11.40 2.20-11.40 x 103/μL

2-12 years 1.50-8.64 1.50-8.50 x 103/μL

12-21 years 1.90-8.64 1.92-8.64 x 103/μL

> 21 years 1.56-6.13 1.78-5.38 x 103/μL

LYMPH#

Age Female Parameter Male Parameter Units

< 2 years 1.20-5.70 1.20-5.70 x 103/μL

2-12 years 0.96-7.29 0.96-7.29 x 103/μL

12-21 years 0.40-3.90 0.40-3.90 x 103/μL

> 21 years 1.18-3.74 1.32-3.57 x 103/μL

MONO#

Age Female Parameter Male Parameter Units

< 2 years 0.10-5.00 0.10-5.00 x 103/μL

2-12 years 0.00-1.20 0.00-1.20 x 103/μL

12-21 years 0.20-0.90 0.20-1.30 x 103/μL

> 21 years 0.24-0.36 0.30-0.82 x 103/μL

EOS#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.50 0.00-0.50 x 103/μL

2-12 years 0.00-0.50 0.00-0.50 x 103/μL

12-21 years 0.00-0.40 0.00-0.40 x 103/μL

> 21 years 0.04-0.36 0.04-0.54 x 103/μL

BASO#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.10 0.00-0.10 x 103/μL

2-12 years 0.00-2.80 0.00-2.27 x 103/μL

12-21 years 0.00-0.10 0.00-0.10 x 103/μL

> 21 years 0.01-0.08 0.01-0.08 x 103/μL

IG#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.28 0.00-0.28 x 103/μL

2-12 years 0.01-0.02 0.01-0.02 x 103/μL

12-21 years 0.01-0.02 0.01-0.02 x 103/μL

> 21 years 0.01-0.02 0.01-0.02 x 103/μL

*[LEAD\_C](#TA13)* **Lead, Blood (Capillary)**

**Reference Interval:**

Age Reference Interval

0-5 years Less than or equal to 3.4 μg/dL

6 years or above Less than or equal to 4.9 μg/dL

**Interpretive Data:**

Elevated results may be due to skin or collection-related contamination, including the use of a noncertified lead-free collection/transport tube. If contamination concerns exist due to elevated levels of blood lead, confirmation with a venous specimen collected in a certified lead-free tube is recommended.

Repeat testing is recommended prior to initiating chelation therapy or conducting environmental investigations of potential lead sources. Repeat testing collections should be performed using a venous specimen collected in a certified lead-free collection tube.

Information sources for blood lead reference intervals and interpretive comments include the CDC’s “Childhood Lead Poisoning Prevention: Recommended Actions Based on Blood Lead Level" and the “Adult Blood Lead Epidemiology and Surveillance: Reference Blood Lead Levels (BLLs) for Adults in the U.S." Thresholds and time intervals for retesting, medical evaluation, and response vary by state and regulatory body. Contact your State Department of

Health and/or applicable regulatory agency for specific guidance on medical management recommendations.

This test was developed and its performance characteristics determined by ARUP Laboratories. It has not been cleared or approved by the U.S. Food and Drug Administration. This test was performed in a CLIA-certified laboratory and is intended for clinical purposes.

|  |  |  |
| --- | --- | --- |
| Group | Concentration | Comment |
| Children | 3.5-19.9 µg/dL | Children under the age of 6 years are the most vulnerable to the harmful effects of lead exposure. Environmental investigation and exposure history to identify potential sources of lead. Biological and nutritional monitoring are recommended. Follow-up blood lead monitoring is recommended. |
| 20-44.9 µg/dL | Lead hazard reduction and prompt medical evaluation are recommended. Contact a Pediatric Environmental Health Specialty Unit or poison control center for guidance. |
| Greater than 44.9 µg/dL | Critical. Immediate medical evaluation, including detailed neurological exam is recommended. Consider chelation therapy when symptoms of lead toxicity are present. Contact a Pediatric Environmental Health Specialty Unit or poison control center for assistance. |
| Adults | 5-19.9 µg/dL | Medical removal is recommended for pregnant women or those who are trying or may become pregnant. Adverse health effects are possible. Reduced lead exposure and increased blood lead monitoring are recommended. |
| 20-69.9 µg/dL | Adverse health effects are indicated. Medical removal from lead exposure is required by OSHA if blood lead level exceeds 50 µg/dL. Prompt medical evaluation is recommended. |
| Greater than 69.9 µg/dL | Critical. Immediate medical evaluation is recommended. Consider chelation therapy when symptoms of lead toxicity are present. |

*[LEAD\_OCC](#TA14)* **Lead, Industrial Exposure Panel in Whole Blood, Adults**

**Reference Interval:**

**Components Reference Interval**

Lead, Blood Less than or equal to 4.9 μg/dL

Zinc Protoporphyrin (ZPP), Whole Blood 0-40 µg/dLZinc Protoporphyrin (ZPP) to Heme Ratio 0-69 µmol ZPP/mol heme

**Interpretive Data:**

Elevated results may be due to skin or collection-related contamination, including the use of a noncertified lead-free collection/transport tube. If contamination concerns exist due to elevated levels of blood lead, confirmation with a second specimen collected in a certified lead-free tube is recommended.

Reference interval and interpretive comments are based on the CDC’s “Childhood Lead Poisoning Prevention: Recommended Actions Based on Blood Lead Level" and the “Adult Blood Lead Epidemiology and Surveillance: Reference Blood Lead Levels (BLLs) for Adults in the U.S." Thresholds and time intervals for retesting, medical evaluation, and response vary by state and regulatory body. Actions described by OSHA in 1978 and finalized in 1983 are shown below. Contact your State Department of Health and/or applicable regulatory agency for specific guidance on medical management recommendations.

|  |  |
| --- | --- |
| Concentration | Comment |
| 5-19.9 µg/dL | Medical removal is recommended for pregnant women or those who are trying or may become pregnant. Adverse health effects are possible. Reduced lead exposure and increased blood lead monitoring are recommended. |
| 20-69.9 µg/dL | Adverse health effects are indicated. Medical removal from lead exposure is required by OSHA if blood lead level exceeds 50 µg/dL. Prompt medical evaluation is recommended. |
| Greater than 69.9 µg/dL | Critical. Immediate medical evaluation is recommended. Consider chelation therapy when symptoms of lead toxicity are present. |

"Occupational Safety and Health Standards: Lead (1983). 29 CFR Part 1910.1025 App C"

Action required for workers with Elevated Lead Values OSHA, Occupational Exposure to Lead, 1978

|  |  |  |
| --- | --- | --- |
| No. of Tests | Lead | Action Required |
| 1 | Greater than or equal to 40.0 µg/dL | Notification of worker in writing; medical examination of worker and consultation |
| 3 (average) | Greater than or equal to 50.0 µg/dL | Removal of worker from job with potential lead exposure. |
| 1 | Greater than or equal to 60.0 µg/dL | Removal of worker from job with potential lead exposure. |
| 2 | Less than 40.0 µg/dL | Reinstatement of worker in job with potential lead exposure is based upon symptoms and medical evaluation |
| OSHA requirements in effect since 1978 call for the measurement of whole blood lead and zinc protoporphyrins (ZPP) (NCCLS document C42-A, Nov. 1996) to evaluate the occupational exposure to lead. OSHA requires ZPP whole blood testing to be reported in units of µg/dL. For adults, conversion of ZPP units of µg/dL whole blood assumes a hematocrit of 45 percent. Conversion factor: µmol/mol heme x 0.584= µg/dL. | | |

This test was developed and its performance characteristics determined by ARUP Laboratories. It has not been cleared or approved by the U.S. Food and Drug Administration. This test was performed in a CLIA-certified laboratory and is intended for clinical purposes.

*[LEAD](#TA15)* **Lead, Whole Blood (Venous)**

**Reference Interval:**

Age Reference Interval

0-5 years Less than or equal to 3.4 μg/dL

6 years or above Less than or equal to 4.9 μg/dL

**Interpretive Data:**

Elevated results may be due to skin or collection-related contamination, including the use of a noncertified lead-free collection/transport tube. If contamination concerns exist due to elevated levels of blood lead, confirmation with a second specimen collected in a certified lead-free tube is recommended.

Information sources for blood lead reference intervals and interpretive comments include the CDC’s “Childhood Lead Poisoning Prevention: Recommended Actions Based on Blood Lead Level" and the “Adult Blood Lead Epidemiology and Surveillance: Reference Blood Lead Levels (BLLs) for Adults in the U.S." Thresholds and time intervals for retesting, medical evaluation, and response vary by state and regulatory body. Contact your State Department of

Health and/or applicable regulatory agency for specific guidance on medical management recommendations.

This test was developed and its performance characteristics determined by ARUP Laboratories. It has not been cleared or approved by the U.S. Food and Drug Administration. This test was performed in a CLIA-certified laboratory and is intended for clinical purposes.

|  |  |  |
| --- | --- | --- |
| Group | Concentration | Comment |
| Children | 3.5-19.9 µg/dL | Children under the age of 6 years are the most vulnerable to the harmful effects of lead exposure. Environmental investigation and exposure history to identify potential sources of lead. Biological and nutritional monitoring are recommended. Follow-up blood lead monitoring is recommended. |
| 20-44.9 µg/dL | Lead hazard reduction and prompt medical evaluation are recommended. Contact a Pediatric Environmental Health Specialty Unit or poison control center for guidance. |
| Greater than 44.9 µg/dL | Critical. Immediate medical evaluation, including detailed neurological exam is recommended. Consider chelation therapy when symptoms of lead toxicity are present. Contact a Pediatric Environmental Health Specialty Unit or poison control center for assistance. |
| Adults | 5-19.9 µg/dL | Medical removal is recommended for pregnant women or those who are trying or may become pregnant. Adverse health effects are possible. Reduced lead exposure and increased blood lead monitoring are recommended. |
| 20-69.9 µg/dL | Adverse health effects are indicated. Medical removal from lead exposure is required by OSHA if blood lead level exceeds 50 µg/dL. Prompt medical evaluation is recommended. |
| Greater than 69.9 µg/dL | Critical. Immediate medical evaluation is recommended. Consider chelation therapy when symptoms of lead toxicity are present. |

*[LIPA](#LIPA_TA)*  **Lipoprotein (a), Serum or Plasma**

**Performing Laboratory:** ARUP Laboratories

**Specimen Requirements:**

**Preferred Container:** Serum Separator Tube

**Specimen Preparation:**  Allow specimen to clot completely at room temperature. Separate from cells ASAP or within 2 hours of collection. Transfer serum or plasma to an ARUP Standard Transport Tube.

**Volume Required:** 1 mL (0.5 mL)

**Unacceptable:** Body Fluids

**Stability**: A: 8 hours; R: 2 weeks; F: 3 months

*[OBS\_PRO](#TA16)* **Obstetric Panel (ABORH, RCB AB, HEP B, RUB, CBC, TREP)**

**Result Codes**:

890-4 Blood Group Antibody Screen

5196-1 Hepatitis B Virus Surface Antigen, Serum

5334-8 Rubella IgG Ab, Serum

51838-1 Treponema Pallidum (Syphillis) IgG Ab Screen

883-9 ABO Blood Type

10331-7 RH Type

6690-2 WBC (White Blood Cell Count)

789-8 RBC (Red Blood Cell Count)

718-7 HGB (Hemoglobin, Whole Blood)

4544-3 HCT (Hematocrit)

787-2 MCV (Mean Cell Volume)

785-6 MCH (Mean Cell Hemoglobin)

786-4 MCHC (Mean Cell Hb Conc)

21000-5 RDW (Red Cell Dist Width)

777-3 PLT (Platelet Count), Whole Blood

32623-1 MPV (Mean Platelet Volume)

770-8 NEUT%

736-9 LYMPH%

5905-5 MONO%

713-8 EOS%

706-2 BASO%

71695-1 IG% New Component

751-8 NEUT#

731-0 LYMPH#

742-7 MONO#

711-2 EOS#

704-7 BASO#

53115-2 IG# New Component

**Updated Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

HGB (Hemoglobin, Whole Blood)

Age Female Parameter Male Parameter Units

< 2 years 10.2-16.6 10.2-16.6 g/dL

2-12 years 10.5-16.0 10.5-16.0 g/dL

12-21 years 11.3-18.0 11.0-18.0 g/dL

> 21 years 11.2 to 15.7 13.7 to 17.5 g/dL

HCT (Hematocrit)

Age Female Parameter Male Parameter Units

< 2 years 29.1-47.7 29.1-47.7 %

2-12 years 29.0-48.0 29.0-48.0 %

12-21 years 32.1-52.0 31.4-52.0 %

> 21 years 34.1-44.9 40.1-51.0 %

MCV (Mean Cell Volume)

Age Female Parameter Male Parameter Units

< 2 years 75.6-106.3 75.6-106.3 fL

2-12 years 74.0-99.0 75.0-99.0 fL

12-21 years 78.0-102.0 79.0-99.0 fL

> 21 years 79.4-94.8 79.0-92.2 fL

MCH (Mean Cell Hemoglobin)

Age Female Parameter Male Parameter Units

< 2 years 26.0-36.4 26.0-36.4 pg

2-12 years 25.0-32.2 24.0-33.0 pg

12-21 years 25.0-35.0 25.0-35.0 pg

> 21 years 25.6-32.2 25.7-32.2 pg

MCHC (Mean Cell Hb Conc)

Age Female Parameter Male Parameter Units

< 2 years 33.6-35.7 33.6-35.7 g/dL

2-12 years 31.0-37.0 32.0-36.5 g/dL

12-21 years 31.0-37.0 32.0-36.7 g/dL

> 21 years 32.2-35.5 32.3-36.5 g/dL

RDW (Red Cell Dist Width)

Age Female Parameter Male Parameter Units

< 2 years 13.3-18.2 13.3-18.2 %

2-12 years 11.6-14.4 11.5-15.0 %

12-21 years 11.5-14.7 11.5-14.6 %

> 21 years 11.7-14.4 11.6-14.4 %

PLT (Platelet Count), Whole Blood

Age Female Parameter Male Parameter Units

< 2 years 95.0-471 95.0-471 x 103/μL

2-12 years 150-450 150-450 x 103/μL

12-21 years 150-450 150-450 x 103/μL

> 21 years 182-369 163-337 x 103/μL

MPV (Mean Platelet Volume)

Age Female Parameter Male Parameter Units

< 2 years 7.3-9.9 7.3-9.9 fL

2-12 years 7.3-12.4 7.2-12.4 fL

12-21 years 6.3-12.4 6.1-12.4 fL

> 21 years 9.4-12.3 9.4-12.4 fL

NEUT%

Age Female Parameter Male Parameter Units

< 2 years 14.6-69.3 14.6-69.3 %

2-12 years 33.6-77.5 23.0-76.7 %

12-21 years 39.6-80.0 33.0-80.0 %

> 21 years 34.0-71.1 34.0-67.9 %

LYMPH%

Age Female Parameter Male Parameter Units

< 2 years 8.0-70.0 8.0-70.0 %

2-12 years 10.0-59.0 8.0-65.0 %

12-21 years 8.0-52.8 8.0-45.8 %

> 21 years 19.3-51.7 21.8-53.1 %

MONO%

Age Female Parameter Male Parameter Units

< 2 years 4.0-19.0 4.0-19.0 %

2-12 years 4.0-12.5 3.0-9.0 %

12-21 years 2.7-12.5 3.0-9.2 %

> 21 years 4.7-12.5 5.3-12.2 %

EOS%

Age Female Parameter Male Parameter Units

< 2 years 1.0-7.0 1.0-7.0 %

2-12 years 1.0-4.0 0.0-5.0 %

12-21 years 0.5-7.2 0.0-6.2 %

> 21 years 0.7-5.8 0.8-7.0 %

BASO%

Age Female Parameter Male Parameter Units

< 2 years 0.0-1.0 0.0-1.0 %

2-12 years 0.0-1.0 0.0-1.0 %

12-21 years 0.0-1.0 0.0-1.3 %

> 21 years 0.1-1.2 0.2-1.2 %

IG%

Age Female Parameter Male Parameter Units

< 2 years 0.00-1.70 0.00-1.70 %

2-12 years 0.19-0.24 0.19-0.24 %

12-21 years 0.19-0.24 0.19-0.24 %

> 21 years 0.19-0.24 0.19-0.24 %

NEUT#

Age Female Parameter Male Parameter Units

< 2 years 2.20-11.40 2.20-11.40 x 103/μL

2-12 years 1.50-8.64 1.50-8.50 x 103/μL

12-21 years 1.90-8.64 1.92-8.64 x 103/μL

> 21 years 1.56-6.13 1.78-5.38 x 103/μL

LYMPH#

Age Female Parameter Male Parameter Units

< 2 years 1.20-5.70 1.20-5.70 x 103/μL

2-12 years 0.96-7.29 0.96-7.29 x 103/μL

12-21 years 0.40-3.90 0.40-3.90 x 103/μL

> 21 years 1.18-3.74 1.32-3.57 x 103/μL

MONO#

Age Female Parameter Male Parameter Units

< 2 years 0.10-5.00 0.10-5.00 x 103/μL

2-12 years 0.00-1.20 0.00-1.20 x 103/μL

12-21 years 0.20-0.90 0.20-1.30 x 103/μL

> 21 years 0.24-0.36 0.30-0.82 x 103/μL

EOS#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.50 0.00-0.50 x 103/μL

2-12 years 0.00-0.50 0.00-0.50 x 103/μL

12-21 years 0.00-0.40 0.00-0.40 x 103/μL

> 21 years 0.04-0.36 0.04-0.54 x 103/μL

BASO#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.10 0.00-0.10 x 103/μL

2-12 years 0.00-2.80 0.00-2.27 x 103/μL

12-21 years 0.00-0.10 0.00-0.10 x 103/μL

> 21 years 0.01-0.08 0.01-0.08 x 103/μL

IG#

Age Female Parameter Male Parameter Units

< 2 years 0.00-0.28 0.00-0.28 x 103/μL

2-12 years 0.01-0.02 0.01-0.02 x 103/μL

12-21 years 0.01-0.02 0.01-0.02 x 103/μL

> 21 years 0.01-0.02 0.01-0.02 x 103/μL

*[RBC](#TA17)*  **RBC (Red Blood Cell Count)**

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Reference Interval:**

RBC (Red Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 3.24-5.08 3.24-5.08 x 106/μL

2-12 years 3.70-5.40 3.85-5.50 x 106/μL

12-21 years 3.79-6.10 3.74-6.10 x 106/μL

> 21 years 3.93-5.22 4.63-6.08 x 106/μL

*[WBC](#TA18)*  **WBC (White Blood Cell Count)**

**Specimen Requirements:**

**Preferred Container:** Lavender Top (EDTA)

**Specimen Preparation:**  Transport 3 mL whole blood. Do not freeze.

**Unacceptable:** Expired specimens, frozen specimens.

**Stability**: A: 24 hours; R: 24 hours; F: Unacceptable

**Reference Interval:**

WBC (White Blood Cell Count)

Age Female Parameter Male Parameter Units

< 2 years 5.90-16.70 5.90-16.70 x 103/μL

2-12 years 4.80-13.50 4.80-13.50 x 103/μL

12-21 years 3.90-13.00 3.70-13.00 x 103/μL

> 21 years 3.98-10.04 4.23-9.07 x 103/μL