Complete Blood Count Reference Interval Diagrams Derived from NHANES III: Stratification by Age, Sex, Race

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Abstract:

Background: Comprehensive, up-to-date "health-associated" reference interval studies of North American populations are uncommon. The third US National Health and Nutrition Examination Survey (NHANES III) was concluded in 1994 and yielded important reference interval data.

Objective: To obtain health-associated Coulter counter reference interval data from NHANES III according to age, sex, and race.

Methods: Of the 29,314 civilian noninstitutionalized US citizens who participated in NHANES III, approximately 25,000 had a complete blood count, red cell distribution width (RDW), platelet count, and automated white blood cell (WBC) differential determined on a Coulter S-Plus Jr. To determine health-associated reference intervals, we used the following exclusion criteria: pregnancy, breast feeding, obesity (body mass index [BMI] >40 and >35 for females and males, respectively), diastolic blood pressure >100 mm Hg, any smoking, any drinking of alcohol, recent treatment for anemia, creatinine level >2.5 mg/dL, glucose level >126 mg/dL, excessive thinness (BMI <8), recent surgery or hospitalization, or having antibodies to hepatitis viruses A, B, or C. The Coulter counter data (hemoglobin, hematocrit, red blood cell count, mean corpuscular volume (MCV), mean cell hemoglobin concentration (MCHC), MCH, WBC count, platelet count, granulocyte count, monocyte count, lymphocyte count, RDW, platelet distribution width, and mean platelet volume) were separated into 6 sex/racial categories (female non-Hispanic white, female non-Hispanic black, female Mexican American, male non-Hispanic white, male non-Hispanic black, and male Mexican American) and 9 age groupings (10–14, 14–18, 18–25, 25–35, 35–45, 45–55, 55–65, 65–75, and >75 years).

Results: There was a high exclusion rate; for example, of the 20,685 individuals with measured hemoglobin levels, 12,688 (61.3%) were excluded. Percentile estimates could be derived accurately for almost all of the female age/sex categories. A few of the male Mexican American and non-Hispanic black categories contained observations for ages 45 to 75 years.

Conclusions: There are age-dependent trends for many of the tests, notably in RDW, MCV, platelet count, and granulocyte and lymphocyte percentages. Sex-dependent changes involved hemoglobin values, and race-related trends centered around mononuclear and lymphocyte percentages, hematocrit, MCHC, MCH, and hemoglobin. This study reveals the potential for using data mining of large samples to yield potentially useful reference ranges.