

# THIRD NHANES USED TO CREATE COMPREHENSIVE HEALTH-ASSOCIATED REFERENCE INTERVALS FOR 21 SERUM CHEMISTRY ANALYTES MEASURED BY THE HITACHI 737

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The 3<sup>rd</sup> U.S. National Health and Nutrition Examination Survey, NHANES III, was conducted between 1988 and 1994 on 29314 civilian noninstitutionalized individuals. Approximately 25,000 individuals, ages 2 months and over, had their blood drawn. Examinees older than 11 years fasted for 10 to 16 hours before the morning phlebotomy or 6 hours before the afternoon or evening phlebotomy. The Hitachi 737 (Boehringer Mannheim Diagnostics, Indianapolis, IN) Was used to measure ALT, albumin, ALP, AST, bicarbonate, urea nitrogen, calcium, cholesterol, creatinine, GGT, glucose, iron, LDH, phosphorus, sodium, potassium, chloride, total bilirubin, total protein, triglycerides and uric acid. The NHANES III data were abstracted from a National Center for Health Statistics CD-ROM (GPO 017-022-01388-6) with Microsoft Access (Redmond, WA) and analyzed with Microsoft Excel. To determine health-associated reference intervals, we used the following exclusion criteria: pregnancy, breast-feeding, obesity (body mass indices [BMI] greater than 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 exceeding 2.5 mg/dL, glucose exceeding 126 mg/dL, use of the birth control pill, excessive thinness (BMI <8) recent surgery or hospitalization, or having antibodies to either hepatitis A or B. The chemistry data were separated in to 6 categories, Female Non-Hispanic White, Female Non-Hispanic Black, Female Mexican-American, Male Non-Hispanic White (MNHW), Male Non-Hispanic Black and Male Mexican American, and finally by age groupings ages 10 to 14, 14 to 18, 18 to 25, 25 to 35, 35 to 45, 45 to 55, 55 to 65, 65 to 75, and over 75. There was a very high exclusion rate; for example, of the 18000 individuals with ALP measured, approximately two thirds were excluded. For the MNHW, many tests have significantly higher upper limits than those suggested by the manufacturer: ALP, ALT, bicarbonate, creatinine, GGT, total protein, urea nitrogen and uric acid. Interestingly, the upper reference limit for AST was similar and LD was lower. The implication of this work is that manufacturer supplied reference intervals may be overly narrow for older, well established tests. Plots of reference intervals vs. age will be available at <http://www.mylaboratoryquality.com>.