National Health and Nutrition Examination Survey

2017-March 2020 Data Documentation, Codebook, and Frequencies

Standard Biochemistry Profile (P_BIOPRO)

Data File: P_BIOPRO.xpt

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Component Description

The NHANES program suspended field operations in March 2020 due to the coronavirus disease 2019 (COVID-19) pandemic. As a result, data collection for the NHANES 2019-2020 cycle was not completed and the collected data are not nationally representative. Therefore, data collected from 2019 to March 2020 were combined with data from the NHANES 2017-2018 cycle to form a nationally representative sample of NHANES 2017-March 2020 pre-pandemic data. These data are available to the public. Please refer to the Analytic Notes section for more details on the use of the data.

These series of measurements are used in the diagnosis and treatment of certain liver, heart, and kidney diseases; acid-base imbalance in the respiratory and metabolic systems; other diseases involving lipid metabolism; various endocrine disorders; as well as other metabolic or nutritional disorders.

Alanine Aminotransferase (ALT)

Alanine aminotransferase measurements are used in the diagnosis and treatment of certain liver diseases (e.g., viral hepatitis and cirrhosis) and heart diseases. Elevated levels of the transaminases can indicate myocardial infarction, hepatic disease, muscular dystrophy, or organ damage. Serum elevations of ALT activity are rarely observed, except in parenchymal liver disease since ALT is a more liver-specific enzyme than aspartate aminotransferase (AST).

Albumin

Albumin measurements are used in the diagnosis and treatment of diseases involving the liver and/or kidneys and are frequently used to assess nutritional status because plasma levels of albumin are dependent on protein intake.

Alkaline Phosphatase (ALP)

Alkaline phosphatase measurements are used in the diagnosis and treatment of liver, bone, and parathyroid disease.

Aspartate Aminotransferase (AST)

AST measurements are used in the diagnosis and treatment of certain types of liver and heart disease. Elevated levels of the transaminases can signal myocardial infarction, hepatic disease, muscular dystrophy, or organ damage.

Bicarbonate (HCO3)

Together with pH determination, bicarbonate measurements are used in the diagnosis and treatment of numerous potentially serious disorders associated with acid-base imbalance in the respiratory and metabolic

systems.

Blood Urea Nitrogen (BUN)

BUN measurements are used in the diagnosis of certain renal and metabolic diseases. The determination of serum urea nitrogen is the most widely used test for the evaluation of kidney function. The test is frequently requested in conjunction with the serum creatinine test for the differential diagnosis of prerenal, renal, and post renal uremia. High BUN levels are associated with impaired renal function, increased protein catabolism, nephritis, intestinal obstruction, urinary obstruction, metallic poisoning, cardiac failure, peritonitis, dehydration, malignancy, pneumonia, surgical shock, Addison's disease, and uremia. Low BUN levels are associated with amyloidosis, acute liver disease, pregnancy, and nephrosis. Normal variations are observed according to a person's age and sex, the time of day, and their diet – particularly in their protein intake.

Creatinine

Creatinine measurements are useful in the diagnosis and treatment of renal diseases.

Creatine Phosphokinase (CPK)

Measurements of creatine phosphokinase are used in the diagnosis and treatment of myocardial infarction, skeletal muscle diseases, and diseases of the central nervous system.

Gamma-glutamyl Transaminase (GGT)

GGT measurements are principally used to diagnose and monitor hepatobiliary disease. It is currently the most sensitive enzymatic indicator of liver disease, with normal values rarely found in the presence of hepatic disease. It is also used as a sensitive screening test for occult alcoholism. Elevated levels are found in patients who chronically take drugs, such as phenobarbital and phenytoin.

Globulin

Globulins are a diverse group of proteins that transport various substances in the blood. They are also involved in various defense mechanisms within the body. Measurements of globulin are calculated **(Total protein - Albumin)** and are used to determine the serum globulin concentration.

Glucose

Glucose measurements are used in the diagnosis and treatment of pancreatic islet cell carcinoma and of carbohydrate metabolism disorders, including diabetes mellitus, neonatal hypoglycemia, and idiopathic hypoglycemia.

Iron

Iron (non-heme) measurements are used in the diagnosis and treatment of diseases, such as iron deficiency anemia, chronic renal disease, and hemochromatosis (a disease associated with widespread deposit in the tissues of two iron-containing pigments, hemosiderin and hemofuscin, and characterized by pigmentation of the skin).

Lactate Dehydrogenase (LDH)

LDH measurements are used in the diagnosis and treatment of liver diseases, such as acute viral hepatitis, cirrhosis, and metastatic carcinoma of the liver; cardiac diseases, such as myocardial infarction; and tumors of the lungs or kidneys.

Osmolality

Serum osmolality is a measure of the number of dissolved particles in a solution and is used to evaluate hydration status and detect potential toxins and foreign substances in the blood. (Osmolality is a calculated value on the chemistry analyzer: [(1.86*Na) + (GLUC/18) + (BUN/2.8) + 9].

Phosphorus

There is a reciprocal relationship between serum calcium and inorganic phosphorus. Any increase in the level of inorganic phosphorus causes a decrease in the calcium level by a mechanism not clearly understood. Hyperphosphatemia is associated with vitamin D hypervitaminosis, hypoparathyroidism, and renal failure. Hypophosphatemia is associated with rickets, hyperparathyroidism, and Fanconi syndrome.

Measurements of inorganic phosphorus are used in the diagnosis and treatment of various disorders, including parathyroid gland, kidney diseases, and vitamin D imbalance.

Potassium, Chloride, and Sodium

Hypokalemia (low serum potassium level) is associated with body potassium deficiency, excessive potassium loss caused by prolonged diarrhea or prolonged periods of vomiting and increased secretion of mineralocorticosteroids. Hyperkalemia (increased serum potassium level) is associated with oliguria, anuria, and urinary obstruction.

Low serum chloride values are associated with salt-losing nephritis; Addisonian crisis, prolonged vomiting, and metabolic acidosis caused by excessive production or diminished excretion of acids. High serum chloride values are associated with dehydration and conditions causing decreased renal blood flow, such as congestive heart failure.

Sodium measurements are used in the diagnosis and treatment of diseases involving electrolyte imbalance.

Total Bilirubin

Elevated levels are associated with hemolytic jaundice, paroxysmal hemoglobinuria, pernicious anemia, polycythemia, icterus neonatorum, internal hemorrhage, acute hemolytic anemia, malaria, and septicemia.

Low bilirubin levels are associated with aplastic anemia, and certain types of secondary anemia resulting from toxic therapy for carcinoma and chronic nephritis.

Total Calcium

Calcium measurements are used in the diagnosis and treatment of parathyroid disease, bone diseases, chronic renal disease, and tetany. Urinary calcium measurement is used in the differential diagnosis of hypercalciuria**.**

Total Cholesterol

An elevated cholesterol level is associated with diabetes, nephrosis, hypothyroidism, biliary obstruction, and those rare cases of idiopathic hypercholesterolemia and hyperlipidemia; low levels are associated with hyperthyroidism, hepatitis, and sometimes severe anemia or infection.

Total Protein

Total protein measurements are used in the diagnosis and treatment of a variety of diseases involving the liver, kidney, or bone marrow, as well as other metabolic or nutritional disorders.

Triglycerides

Triglyceride measurements are used in the diagnosis of diabetes mellitus, nephrosis, liver obstruction, and other diseases involving lipid metabolism and various endocrine disorders and in the treatment of patients with these diseases.

Uric Acid

Uric acid measurements are used in the diagnosis and treatment of numerous renal and metabolic disorders, including renal failure, gout, leukemia, psoriasis, starvation, or other wasting conditions and in the treatment of patients receiving cytotoxic drugs.

Eligible Sample

All examined participants aged 12 years and older, in the NHANES 2017-March 2020 pre-pandemic sample, were eligible.

Description of Laboratory Methodology

NOTE: Glucose, cholesterol, and triglyceride were analyzed 1) as part of the biochemistry profile in this dataset; and 2) at other institutions, which are considered the reference methods for these measures. The results in this dataset do not replace the reference method data. See Analytical Notes section below for more detailed information.

All methods were measured on the Roche Cobas 6000 (c501 module) analyzer. See Laboratory Method Files for more detailed information about analyte methodologies, principles, and operating procedures.

Alanine Aminotransferase (ALT)

The method to measure alanine aminotransferase (ALT) catalyzes the reaction of alpha-ketoglutarate with L-alanine to form L-glutamate and pyruvate. Under the action of LDH, pyruvate converts to lactate, and NADH is converted to NAD. The decrease in absorbance of NADH, measured at 340 nm (secondary wavelength is 700 nm), is directly proportional to the serum activity of ALT. It is a kinetic rate reaction.

Albumin

The method to measure albumin concentration utilizes the dye bromcresol purple (BCP). When the dye binds selectively with albumin in a pH range of 5.2-6.8, a color change occurs that is measured at 600 nm. The secondary wavelength is 700 nm. This is a 2-point, endpoint reaction that is specific for albumin.

Aspartate Aminotransferase (AST)

Aspartate aminotransferase (AST) activity is determined by a modification of the method recommended by the International Federation of Clinical Chemistry (IFCC). AST catalyzes the reaction of alpha-ketoglutarate with L-aspartate to form L-glutamate and oxaloacetate. Under the action of malate dehydrogenase (MDH), oxaloacetate converts to malate, and NADH is oxidized to NAD. The decrease in absorbance of NADH, measured at 340 nm (secondary wavelength = 700 nm), is directly proportional to the serum activity of AST. It is a kinetic rate reaction.

Alkaline Phosphatase (ALP)

The method to measure alkaline phosphatase (ALP) utilizes a simple reaction wherein ALP acts upon a substrate (p-nitrophenol phosphate, or PNPP) in the presence of magnesium and zinc activators to form a colored product (p-nitrophenol) whose appearance is measured at 450 nm. The rate of p-nitrophenol formation is directly related to the amount of alkaline phosphatase in the specimen.

Bicarbonate (HCO_3)

The method to measure bicarbonate (HCO_3) utilizes an enzyme-based reaction. Phosphoenolpyruvate (PEP) is added to the specimen containing bicarbonate. Under the action of phosphoenolpyruvate carboxylase (PEPC) the PEP accepts the bicarbonate and is converted to oxaloacetate. Then under the action of malate dehydrogenase, and in the presence of an NADH analog, the oxaloacetate is converted to malate, with the NADH analog converting to an NAD analog. The rate of disappearance of NADH analog is measured at 415 nm, and it is directly proportional to the amount of bicarbonate in the specimen.

Blood Urea Nitrogen (BUN)

The method to measure blood urea nitrogen utilizes a coupled enzyme reaction (urease, followed by glutamate dehydrogenase), with measurement of NADH (converting to NAD+) occurring at 340 nm.

Creatine Phosphokinase (CPK)

The method to measure creatine phosphokinase (CPK) or creatine kinase (CK) utilizes a coupled enzyme reaction. Creatine phosphate and adenosine diphosphate (ADP) are acted upon by CK in the serum specimen. Creatine and ATP are produced from this reaction, and ATP reacts with glucose under the action of hexokinase to produce glucose-6-phosphate and ADP. The glucose-6-phosphate reacts with NADP under the action of glucose-6-phosphate dehydrogenase to produce NADPH and a by-product. The photometrically (340 nm) measured rate of NADPH formation is directly proportional to the CK activity in the specimen.

Creatinine

Creatinine is measured using an enzymatic method in which creatinine is converted to creatine under the activity of creatininase. Creatine is then acted upon by creatinase to form sarcosine and urea. Sarcosine oxidase converts sarcosine to glycine and hydrogen peroxide, and the hydrogen peroxide reacts with a chromophore in the presence of peroxidase to produce a colored product that is measured at 546 nm (secondary wavelength = 700 nm). This is an endpoint reaction that agrees well with recognized HPLC methods, and it has the advantage over Jaffe picric acid-based methods that are susceptible to interferences from non-creatinine chromogens.

Gamma-glutamyl Transaminase (GGT)

The method to measure gamma-glutamyl transaminase (GGT) is a slight modification (slightly different substrate) of the method introduced by Szasz in 1969 (Whitfield JB, et. al., 1972) In the presence of glycylglycine, L-gamma-glutamyl-3-carboxy-4-nitroanilide is converted by GGT to 5-amino-2-nitrobenzoate and L-gamma-glutamyl-glycylglycine. The rate of colored product formation is directly related to the amount of GGT in the specimen, and the rate of its appearance is measured at 415 nm (secondary wavelength 700 nm). This is a kinetic (Rate-A) reaction.

Glucose

The method to measure glucose utilizes an enzymatic method that converts glucose to glucose-6-phosphate (G-6-P) by hexokinase in the presence of ATP, a phosphate donor. Glucose-6-phosphate dehydrogenase then converts the G-6-P to gluconate-6-P in the presence of NADP+. As the NADP+ is reduced to NADPH during this reaction, the resulting increase in absorbance at 340 nm (secondary wavelength = 700 nm) is measured. This is an endpoint reaction that is specific for glucose.

Iron

The Roche method of iron measurement is a three-step process using the FerroZine reagent: Fe3+ is liberated from transferrin by acid/detergent, Fe3+ is reduced to Fe2+ by ascorbate, and the reduced iron then reacts with the FerroZine reagent to form a colored complex. The intensity of this final product is directly proportional to the iron concentration in the specimen.

Lactate Dehydrogenase (LDH)

The Roche method of LDH measurement is derived from the formulation recommended by the International Federation of Clinical Chemistry (IFCC) and is optimized for performance and stability. In the presence of cofactor NAD+, LDH converts L-lactate to pyruvate. NAD+ is reduced to NADH during this reaction. The initial rate of NADH formation is directly proportional to the catalytic LDH activity and is determined by measuring the increase in absorbance at 340 nm. This is a kinetic (Rate-A) reaction.

Phosphorus

The method used to measure phosphorus utilizes ammonium molybdate as the color-forming reagent. Measurement of the final product occurs at 340 nm (secondary wavelength 700 nm). Inorganic phosphate forms an ammonium phosphomolybdate complex having the formula (NH4)3[PO4(MoO3)12] with ammonium molybdate in the presence of sulfuric acid. The concentration of phosphomolybdate formed is directly proportional to the inorganic phosphate concentration.

Potassium, Chloride, & Sodium

An Ion-Selective Electrode (ISE) makes use of the unique properties of certain membrane materials to develop an electrical potential (electromotive force, EMF) for the measurements of ions in solution. The electrode has a selective membrane in contact with both the test solution and an internal filling solution. The internal filling solution contains the test ion at a fixed concentration. Because of the particular nature of the membrane, the test ions will closely associate with the membrane on each side. The membrane EMF is determined by the difference in concentration of the test ion in the test solution and the internal filling solution. The complete measurement system for a particular ion includes the ISE, a reference electrode, and electronic circuits to measure and process the EMF to give the test ion concentration. The sodium and potassium electrodes are based on neutral carriers and the chloride electrode is based on an ion exchanger.

Chloride is measured using an indirect (specimen is diluted (1:31) by the instrument prior to analysis) ion-selective electrode (ISE) method for determination of the serum electrolyte concentrations.

Potassium ion concentration is measured by electrolyte activity in solution. This method utilizes an indirect (specimen is diluted by the instrument prior to analysis) ion-selective electrode (ISE) method for determination of the serum electrolyte concentrations.

Sodium is measured by the Roche Cobas 6000 (c501 module) system by utilizing indirect (or diluted) I.S.E. (ion selective electrode) methodology. This method utilizes an indirect (specimen is diluted by the instrument prior to analysis) ion-selective electrode (ISE) method for determination of the serum electrolyte concentrations.

Total Bilirubin

The method to measure total bilirubin is coupled with 3,5-dichlorophenyl diazonium in the presence of a solubilizing agent in a strongly acidic medium. The intensity of the red azo dye formed is directly proportional to the total bilirubin and can be determined photometrically (546 nm).

Total Calcium

The method used to measure total calcium reacts with 5-nitro-5'methyl-BAPTA (NM-BAPTA) under alkaline conditions to form a complex. This complex then reacts with EDTA to form a colored product whose intensity is directly proportional to the concentration of calcium in the specimen. It is measured photometrically at 340 nm.

Total Cholesterol

The method used to measure cholesterol is an enzymatic method where esterified cholesterol is converted to cholesterol by cholesterol esterase. The resulting cholesterol is then acted upon by cholesterol oxidase to

produce cholest-4-en-3-one and hydrogen peroxide. The hydrogen peroxide then reacts with 4-aminophenazone in the presence of peroxidase to produce a colored product that is measured at 505 nm (secondary wavelength = 700 nm). The final step is known as the Trinder reaction. This method is a single reagent, endpoint reaction that is specific for cholesterol.

Total Protein

The total protein method utilizes the biuret reaction with measurement of the final product at 546 nm. Divalent copper reacts in alkaline solution with protein peptide bonds to form the characteristic purple-colored biuret complex. Sodium potassium tartrate prevents the precipitation of copper hydroxide and potassium iodide prevents auto-reduction of copper. The color intensity is directly proportional to the protein concentration.

Triglycerides

The method used to measure triglyceride is based on the work by Wahlefeld using a lipoprotein lipase from microorganisms for the rapid and complete hydrolysis of triglycerides to glycerol followed by oxidation to dihydroxyacetone phosphate and hydrogen peroxide. The hydrogen peroxide produced then reacts with 4-aminophenazone and 4-chlorophenol under the catalytic action of peroxidase to form a red dyestuff (Trinder endpoint reaction). The color intensity of the red dyestuff formed is directly proportional to the triglyceride concentration and can be measured photometrically.

Uric Acid

In this method uric acid is oxidized by uricase. Then the peroxide produced from this reaction is acted upon by peroxidase in the presence of 4 aminophenazone to produce a measurable colored product. It is a two-point, endpoint reaction, with measurement occurring at 546 nm (secondary wavelength 700 nm).

Refer to the Laboratory Method Files section for a detailed description of the laboratory methods used.

Laboratory Method Files

BIOPRO - Alanine Amino Transferase (ALT) (February 2020)

BIOPRO - Albumin (February 2020)

BIOPRO - Alkaline Phosphatase (ALP) (February 2020)

BIOPRO - Aspartate Aminotransferase (AST) (February 2020)

BIOPRO - Bicarbonate (HCO3) (February 2020)

BIOPRO - Blood Urea Nitrogen (BUN) (February 2020)

BIOPRO - Chloride (February 2020)

BIOPRO - Creatine Phosphokinase (CPK) (February 2020)

BIOPRO - Creatinine (February 2020)

BIOPRO - Glucose - Serum - Refrigerated (February 2020)

BIOPRO - Gamma-Glutamyl Transferase (GGT) (February 2020)

BIOPRO - Iron - Refrigerated (February 2020)

BIOPRO - Lactate Dehydrogenase (LDH) (February 2020)

BIOPRO - Phosphorus (February 2020)

BIOPRO - Potassium (February 2020)

BIOPRO - Sodium (February 2020)

BIOPRO - Total Bilirubin (February 2020)

BIOPRO - Total Calcium (February 2020)

BIOPRO - Total Cholesterol - Refrigerated (February 2020)

BIOPRO - Total Protein (February 2020)

BIOPRO - Triglycerides - Refrigerated (February 2020)

BIOPRO - Uric Acid (February 2020)

BIOPRO - Alanine Amino Transferase (ALT) (August 2021)

BIOPRO - Albumin (August 2021)

BIOPRO - Alkaline Phosphatase (ALP) (August 2021)

BIOPRO - Aspartate Aminotransferase (AST) (August 2021)

BIOPRO - Bicarbonate (HCO3) (August 2021)

BIOPRO - Blood Urea Nitrogen (BUN) (August 2021)

BIOPRO - Chloride (August 2021)

BIOPRO - Creatine Phosphokinase (CPK) (August 2021)

BIOPRO - Creatinine (August 2021)

BIOPRO - Glucose - Serum - Refrigerated (August 2021)

BIOPRO - Gamma-Glutamyl Transferase (GGT) (August 2021)

BIOPRO - Iron - Refrigerated (August 2021)

BIOPRO - Lactate Dehydrogenase (LDH) (August 2021)

BIOPRO - Phosphorus (August 2021)

BIOPRO - Potassium (August 2021)

BIOPRO - Sodium (August 2021)

BIOPRO - Total Bilirubin (August 2021)

BIOPRO - Total Calcium (August 2021)

BIOPRO - Total Cholesterol - Refrigerated (August 2021)

BIOPRO - Total Protein (August 2021)

BIOPRO - Triglycerides - Refrigerated (August 2021)

BIOPRO - Uric Acid (August 2021)

Laboratory Quality Assurance and Monitoring

Serum specimens are processed, stored, and shipped to the University of Minnesota – Advanced Research Diagnostics Laboratory (ARDL), Minneapolis, MN for analysis.

Detailed instructions on specimen collection and processing are discussed in the NHANES 2017-2018 and 2019-2020 Laboratory Procedures Manuals (LPMs). Vials are stored under appropriate refrigerated (2-8°C) conditions until they are shipped to Collaborative Laboratory Services for testing.

The NHANES quality assurance and quality control (QA/QC) protocols meet the 1988 Clinical Laboratory Improvement Act mandates. Detailed QA/QC instructions are discussed in the NHANES LPMs.

Mobile Examination Centers (MECs)

Laboratory team performance is monitored using several techniques. NCHS and contract consultants use a structured competency assessment evaluation during visits to evaluate both the quality of the laboratory work and the QC procedures. Each laboratory staff member is observed for equipment operation, specimen collection and preparation; testing procedures and constructive feedback are given to each staff member. Formal retraining sessions are conducted annually to ensure that required skill levels were maintained.

Analytical Laboratories

NHANES uses several methods to monitor the quality of the analyses performed by the contract laboratories. In the MEC, these methods include performing blind split specimens collected during “dry run” sessions. In addition, contract laboratories randomly perform repeat testing on 2% of all specimens.

NCHS developed and distributed a quality control protocol for all CDC and contract laboratories, which outlined the use of Westgard rules (Westgard, et al. 1981) when testing NHANES specimens. Progress reports containing any problems encountered during shipping or receipt of specimens, summary statistics for each control pool, QC graphs, instrument calibration, reagents, and any special considerations are submitted to NCHS quarterly. The reports are reviewed for trends or shifts in the data. The laboratories are required to explain any identified areas of concern.

Data Processing and Editing

The data were reviewed. Incomplete data or improbable values were sent to the performing laboratory for confirmation.

There were 13 additional variables created in this data file to convert the analyzed values into International System of Units (SI). These variables were created using the following formulas:

LBXSAL conversion to LBDSALSI

Albumin in g/dL (LBXSAL) was converted to g/L (LBDSALSI) by multiplying by **10**

LBXSBU conversion to LBDSBUSI

Blood urea nitrogen (BUN) in mg/dL (LBXSBU) was converted to mmol/L (LBDSBUSI) by multiplying by **0.357**

LBXSCA conversion to LBDSCASI

Calcium in mg/dL (LBXSCA) was converted to mmol/L (LBDSCASI) by multiplying by **0.250**

LBXSCH conversion to LBDSCHSI

Cholesterol in mg/dL (LBXSCH) was converted to mmol/L (LBDSCHSI) by multiplying by **0.0259**

LBXSCR conversion to LBDSCRSI

Creatinine in mg/dL (LBXSCR) was converted to µmol/L (LBDSCRSI) by multiplying by **88.4**

LBXSGL conversion to LBDSGLSI

Glucose in mg/dL (LBXSGL) was converted to mmol/L (LBDSGLSI) by multiplying by **0.0555**

LBXSIR conversion to LBDSIRSI

Iron in µg/dL (LBXSIR) was converted to µmol/L (LBDSIRSI) by multiplying by **0.1791**

LBXSPH conversion to LBDSPHSI

Phosphorus in mg/dL (LBXSPH) was converted to mmol/L (LBDSPHSI) by multiplying by **0.323**

LBXSTB conversion to LBDSTBSI

Total bilirubin in mg/dL (LBXSTB) was converted to µmol/L (LBDSTBSI) by multiplying by **17.1**

LBXSTP conversion to LBDSTPSI

Total protein in g/dL (LBXSTP) was converted to g/L (LBDSTPSI) by multiplying by **10**

LBXSTR conversion to LBDSTRSI

Triglycerides in mg/dL (LBXSTR) were converted to mmol/L (LBDSTRSI) by multiplying by **0.0113**

LBXSTR conversion to LBDSTRSI

Uric acid in mg/dL (LBXSUA) was converted to µmol/L (LBDSUASI) by multiplying by **59.48**

LBXSGB conversion to LBDSGBSI

Globulin in g/dL (LBXSGB) was converted to g/L (LBDSGBSI) by multiplying by **10**

Analytic Notes

The COVID-19 pandemic required suspension of NHANES 2019-2020 field operations in March 2020 after data were collected in 18 of the 30 survey locations in the 2019-2020 sample. Data collection was cancelled for the remaining 12 locations. Because the collected data from 18 locations were not nationally representative, these data were combined with data from the previous cycle (2017-2018) to create a 2017-March 2020 pre-pandemic data file. A special weighting process was applied to the 2017-March 2020 pre-pandemic data file. The resulting sample weights in the present file should be used to calculate estimates from the combined cycles. These sample weights are not appropriate for independent analyses of the 2019-2020 data and will not yield nationally representative results for either the 2017-2018 data alone or the 2019-March 2020 data alone. Please refer to the NHANES website for additional information for the NHANES 2017-March 2020 pre-pandemic data, and for the previous 2017-2018 public use data file with specific weights for that 2-year cycle.

Refer to the 2017-2018 and 2019-2020 Laboratory Data Overview documents for general information on NHANES laboratory data.

There are over 800 laboratory tests performed on NHANES participants. However, not all participants provided biospecimens or enough volume for all the tests to be performed. The specimen availability can also vary by age or other population characteristics. For example, in 2017-March 2020, approximately 76% of children aged 1-17 years who were examined in the MEC provided a blood specimen through phlebotomy, while 95% of examined adults age 18 and older provided a blood specimen. Analysts should evaluate the extent of missing data in the dataset related to the outcome of interest as well as any predictor variables used in the analyses to determine whether additional re-weighting for item non-response is necessary.

Please refer to the NHANES Analytic Guidelines and the on-line NHANES Tutorial for further details on the use of sample weights and other analytic issues.

Demographic and Other Related Variables

The analysis of NHANES laboratory data must be conducted using the appropriate survey design and demographic variables. The NHANES 2017-March 2020 Pre-pandemic Demographics File contains demographic data, health indicators, and other related information collected during household interviews as well as the sample design variables. The recommended procedure for variance estimation requires use of stratum and PSU variables (SDMVSTRA and SDMVPSU, respectively) in the demographic data file.

The 2017-March 2020 Pre-pandemic Fasting Questionnaire File includes auxiliary information, such as fasting status, length of fast and the time of venipuncture.

This laboratory data file can be linked to the other NHANES data files using the unique survey participant identifier (i.e., SEQN).

Glucose (LBXSGL)

This glucose value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result from the reference method (LBXGLU), rather than the standard battery of biochemical assessments value (LBXSGL), is generally recommended. These serum glucose values (LBXSGL) reported in this data file should not be used to determine undiagnosed diabetes or prediabetes. Instead, plasma glucose values (LBXGLU) should be used, which are based on the reference analytic method in the **GLU_K** data file. Special weights included in the **GLU_K** data file should be used when analyzing these data.

Total Cholesterol (LBXSCH)

This total cholesterol value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result from the reference method (LBXTC), rather than the standard battery of biochemical assessments value (LBXSCH), is generally recommended. For most serum cholesterol analyses, the appropriate variable to use will be (LBXTC) in the **TCHOL_K** data file. The (LBXSCH) value from the standard biochemistry profile should not be used routinely.

Triglycerides (LBXSTR)

This triglyceride value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result from the reference method (LBXTR), rather than the standard battery of biochemical assessments value (LBXSTR), is generally recommended. For most triglyceride analyses, the appropriate variable to use is (LBXTR) in the **TRIGLY_K** data file. The value from the standard biochemistry profile (LBXSTR) should not be used routinely.

Detection Limits

The detection limits were constant for all of the analytes in the data set.

The lower limit of detection (LLOD) for the Standard Biochemistry Profile:

Variable Name	ANALYTE DESCRIPTION	LLOD
LBXSATSI	Alanine Aminotransferase (ALT) (U/L)	3
LBXSAL	Albumin, refrigerated serum (g/dL)	0.3
LBXSAPSI	Alkaline Phosphatase (ALP) (U/L)	2
LBXSASSI	Aspartate Aminotransferase (AST) (U/L)	3
LBXSC3SI	Bicarbonate (mmol/L)	2
LBXSBU	Blood Urea Nitrogen (g/dL)	2
LBXSCLSI	Chloride (mmol/L)	65
LBXSCK	Creatine Phosphokinase (CPK) (IU/L)	3
LBXSCR	Creatinine, refrigerated serum (mg/dL)	0.10
LBXSGTSI	Gamma-Glutamyl Transferase (GGT) (U/L)	3
LBXSGL	Glucose, refrigerated serum (mg/dL)	2
LBXSIR	Iron, refrigerated serum (ug/dL)	5
LBXSLDSI	Lactate Dehydrogenase (LDH) (U/L)	8
LBXSPH	Phosphorus (mg/dL)	0.3
LBXSKSI	Potassium (mmol/L)	1.5
LBXSNASI	Sodium (mmol/L)	100
LBXSTB	Total Bilirubin (mg/dL)	0.1
LBXSCA	Total Calcium (mg/dL)	0.8
LBXSCH	Total Cholesterol, refrigerated serum (mg/dL)	5
LBXSTP	Total Protein (g/dL)	0.3
LBXSTR	Triglycerides, refrigerated serum (mg/dL)	9
LBXSUA	Uric Acid (mg/dL)	0.2

Standard Biochemistry Profile regression equations to compare 2017-March 2020 and 2015-2016 data:

Method validation (bridging) studies were performed to compare results from a laboratory, instrument, and method change between the 2015-2016 and 2017-2018 survey cycles using NHANES samples from late 2016. During the 2015-2016 cycle the Beckman Coulter UniCel DxC 800 Synchron was upgraded to the Beckman Coulter UniCel DxC 660i Synchron Access chemistry analyzer (DxC 660i). Previous analyses indicated that no statistical adjustment is needed for results obtained between the two Beckman UniCel® analyzers (i.e., DxC 800 and DxC 660i). During the 2017-2018 cycle the Roche Cobas 6000 chemistry analyzer (Cobas 6000) was used for the entire 2017-2018 cycle. Analyses comparing results obtained from the Cobas 6000 to those obtained from the DxC 660i using selected serum samples (n=248) from NHANES participants in 2016 indicate that adjustments are needed for some analytes as described below.

The table below provides a list of the standard biochemistry profile analytes and results from the bridging study for each analyte. It includes mean differences (% Diff), correlation coefficients (r), and when recommended the regression model used for the adjustment as well as the forward and backward adjustment equations. When differences between the two measurements were proportional to concentration, Weighted Deming regressions were chosen to adjust the results. When differences were constant across the interval of concentration, a non-weighted Deming regression was chosen. A Log Deming regression was used to adjust an analyte whose measurements were heavily skewed to the right. All analyses were performed using Analyse-it, v4.30.4.

It is recommended that these equations be used when examining trends among standard biochemistry profile data across 1999-2016 and 2017-2018 cycles, or when combining 2017-2018 data with previous cycles. For more detailed information on the standard biochemistry profile data files in the previous cycles, please refer to the documentations accompanying these datasets.

VARIABLE NAME (unit)	STATISTICAL ADJUSTMENT METHOD	FORWARD EQUATIONS [CI]	BACKWARD EQUATIONS [CI]	% DIFF	r
LBXSAL (g/dL)	Non-weighted Deming	**X** (Cobas 6000) **= 0.9581** [95%CI: 0.9282 to 0.9881] *** Y** (DxC 660i) **- 0.0108** [95%CI: -0.1413 to 0.1197]	**X** (DxC 660i) **= 1.044** [95%CI: 1.011 to 1.076] *** Y** (Cobas 6000) **+ 0.01128** [95%CI: -0.1247 to 0.1473]	-4.42	0.968
LBXSAPSI (U/L)	Log Deming Regression	**Log_{10} X** (Cobas 6000) = **0.9986** [95%CI: 0.9915 to 1.006] *** Log_{10} Y** (DxC 660i) **+ 0.04288** [95% CI: 0.02936 to 0.05640]	**Log_{10} X** (DxC 660i) **= 1.001** [95%CI: 0.9943 to 1.009] *** Log_{10} Y** (Cobas 6000) **- 0.04294** [95%CI: -0.05678 to -0.02911]	9.74	1.000
LBXSASSI (U/L)	Non-weighted Deming	**X** (Cobas 6000) **= 0.9822** [95% CI: 0.9673 to 0.9970] *** Y** (DxC 660i) **- 3.695** [95% CI: -4.093 to -3.298]	**X** (DxC 660i) **= 1.018** [95%CI: 1.003 to 1.034] *** Y** (Cobas 6000) **+ 3.762** [95%CI: 3.409 to 4.115]	-18.03	0.990
LBXSATSI (U/L)	Non-weighted Deming	**X** (Cobas 6000) **= 0.9869** [95% CI: 0.9762 to 0.9976] *** Y** (DxC 660i) **- 2.653** [95% CI: -2.919 to -2.387]	**X** (DxC 660i) **= 1.013** [95%CI: 1.002 to 1.024] *** Y** (Cobas 6000) **+ 2.688** [95%CI: 2.443 to 2.934]	-15.46	0.997
LBXSBU (g/dL)	Non-weighted Deming	**X** (Cobas 6000) **= 0.9992** [95% CI: 0.9827 to 1.016] *** Y** (DxC 660i) **- 0.4484** [95% CI: -0.6835 to -0.2134]	**X** (DxC 660i) **= 1.001** [95%CI: 0.9843 to 1.017] *** Y** (Cobas 6000) **+ 0.4488** [95%CI: 0.2207 to 0.6768]	-3.36	0.992
LBXSC3SI (mmol/L)	Adjustment Not Recommended	N/A	N/A	1.74	0.749
LBXSCA (mg/dL)	Adjustment Not Recommended	N/A	N/A	-2.12	0.892
LBXSCH (mg/dL)	Weighted Deming	**X** (Cobas 6000) **= 0.9556** [95% CI: 0.9419 to 0.9693] *** Y** (DxC 660i) **+ 2.105** [95% CI: -0.1178 to 4.328]	**X** (DxC 660i) **= 1.046** [95%CI: 1.031 to 1.062] *** Y** (Cobas 6000) **- 2.203** [95%CI: -4.560 to 0.1550]	-3.21	0.990
LBXSCK[1] (IU/L)	Weighted Deming	**X** (Cobas 6000) **= 1.068** [95% CI: 1.062 to 1.075] *** Y** (DxC 660i) **- 1.131** [95% CI: -1.906 to -0.3569]	**X** (DxC 660i) **= 0.9360** [95%CI: 0.9303 to 0.9416] *** Y** (Cobas 6000) **+ 1.059** [95%CI: 0.3399 to 1.778]	5.91	1.000
LBXSCLSI (IU/L)	Adjustment Not Recommended	N/A	N/A	-1.44	0.756
LBXSCR (mg/dL)	Non-weighted Deming	**X** (Cobas 6000) **= 0.9515** [95% CI: 0.9365 to 0.9665] *** Y** (DxC 660i) **+ 0.06608** [95% CI: 0.05252 to 0.07963]	**X** (DxC 660i) **= 1.051** [95%CI: 1.034 to 1.068] *** Y** (Cobas 6000) **- 0.06945** [95%CI: -0.08474 to -0.05415]	3.354	0.993
LBXSGB (g/dL)	CALCULATED	N/A	N/A	N/A	N/A

LBXSGL (mg/dL)	Adjustment Not Recommended	N/A	N/A	2.41	0.999
LBXSGTSI (U/L)	Weighted Deming	**X** (Cobas 6000) **= 1.243** [95% CI: 1.223 to 1.263] *** Y** (DxC 660i) **- 2.938** [95% CI: -3.352 to -2.524]	**X** (DxC 660i) **= 0.8042** [95%CI: 0.7913 to 0.8172] *** Y** (Cobas 6000) **+ 2.363** [95%CI: 2.066 to 2.660]	7.7	0.999
LBXSIR (ug/dL)	Non-weighted Deming	**X** (Cobas 6000) **= 1.023** [95% CI: 1.013 to 1.033] *** Y** (DxC 660i) **+ 4.597** [95% CI: 3.839 to 5.354]	**X** (DxC 660i) **= 0.9776** [95%CI: 0.9678 to 0.9873] *** Y** (Cobas 6000) **- 4.494** [95%CI: -5.275 to -3.712]	10.01	0.998
LBXSKSI (mmol/L)	Adjustment Not Recommended	N/A	N/A	-1.398	0.970
LBXSLDSI (U/L)	Weighted Deming	**X** (Cobas 6000) **= 1.167** [95% CI: 1.141 to 1.194] *** Y** (DxC 660i) **- 2.407** [95% CI: -5.758 to 0.9439]	**X** (DxC 660i) **= 0.8568** [95%CI: 0.8373 to 0.8762] *** Y** (Cobas 6000) **+ 2.062** [95%CI: -0.7646 to 4.890]	14.86	0.987
LBXSNASI (mmol/L)	Adjustment Not Recommended	N/A	N/A	0.80	0.605
LBXSOSSI (mmol/Kg)	CALCULATED	N/A	N/A	N/A	N/A
LBXSPH (mg/dL)	Adjustment Not Recommended	N/A	N/A	-1.80	0.992
LBXSTB (mg/dL)	Adjustment Not Recommended	N/A	N/A	-3.19	0.938
LBXSTP (g/dL)	Adjustment Not Recommended	N/A	N/A	0.36	0.932
LBXSTR (mg/dL)	Non-weighted Deming	**X** (Cobas 6000) **= 1.036** [95% CI: 0.9973 to 1.074] *** Y** (DxC 660i) **+ 7.271** [95% CI: 3.361 to 11.18]	**X** (DxC 660i) **= 0.9655** [95%CI: 0.9293 to 1.002] *** Y** (Cobas 6000) **- 7.020** [95%CI: -11.09 to -2.945]	13.44	0.997
LBXSUA (mg/dL)	Non-weighted Deming	**X** (Cobas 6000) **= 1.073** [95% CI: 1.060 to 1.085] *** Y** (DxC 660i) **- 0.2495** [95% CI: -0.3167 to -0.1823]	**X** (DxC 660i) **= 0.9323** [95%CI: 0.9212 to 0.9435] *** Y** (Cobas 6000) **+ 0.2326** [95%CI: 0.1727 to 0.2925]	2.37	0.996

1. One of the data points was deemed an extreme outlier, therefore only data from 247 serum samples were used in the analysis for creatinine phosphokinase (LBXSCK).

References

- Wahlefeld, August W. Triglycerides Determination after Enzymatic Hydrolysis. Methods of Enzymatic Analysis (2nd English Edition). 1974. 4:1831-1835.
- Westgard J.O., Barry P.L., Hunt M.R., Groth T. A multi-rule Shewhart chart for quality control in clinical chemistry. Clin Chem (1981) 27:493-501.
- Whitfield JB, Pounder RE, Neale G, et al. Serum γ-glutamyl transpeptidase activity in liver disease. Gut 1972;13:702-708.

Codebook and Frequencies

SEQN - Respondent Sequence Number

Variable Name:	SEQN
SAS Label:	Respondent Sequence Number
English Text:	Respondent Sequence Number
Target:	Both males and females 12 YEARS - 150 YEARS

LBXSATSI - Alanine Aminotransferase (ALT) (U/L)

Variable Name: LBXSATSI

SAS Label: Alanine Aminotransferase (ALT) (U/L)

English Text: Alanine Aminotransferase (ALT) (U/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2 to 682	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSATLC - ALT Comment Code

Variable Name: LBDSATLC

SAS Label: ALT Comment Code

English Text: Alanine Aminotransferase (ALT) Comment Code

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above detection limit	9471	9471	
1	Below lower detection limit	2	9473	
.	Missing	936	10409	

LBXSAL - Albumin, refrigerated serum (g/dL)

Variable Name: LBXSAL

SAS Label: Albumin, refrigerated serum (g/dL)

English Text: Albumin, refrigerated serum (g/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2.1 to 5.4	Range of Values	9477	9477	
.	Missing	932	10409	

LBDSALSI - Albumin, refrigerated serum (g/L)

Variable Name: LBDSALSI

SAS Label: Albumin, refrigerated serum (g/L)

English Text: Albumin, refrigerated serum(g/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
21 to 54	Range of Values	9477	9477	
.	Missing	932	10409	

LBXSAPSI - Alkaline Phosphatase (ALP) (IU/L)

Variable Name: LBXSAPSI

SAS Label: Alkaline Phosphatase (ALP) (IU/L)

English Text: Alkaline Phosphatase (ALP) (IU/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
16 to 638	Range of Values	9474	9474	
.	Missing	935	10409	

LBXSASSI - Aspartate Aminotransferase (AST) (U/L)

Variable Name: LBXSASSI

SAS Label: Aspartate Aminotransferase (AST) (U/L)

English Text: Aspartate Aminotransferase (AST) (U/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
6 to 489	Range of Values	9435	9435	
.	Missing	974	10409	

LBXSC3SI - Bicarbonate (mmol/L)

Variable Name: LBXSC3SI

SAS Label: Bicarbonate (mmol/L)

English Text: Bicarbonate (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
14 to 38	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSBU - Blood Urea Nitrogen (mg/dL)

Variable Name: LBXSBU

SAS Label: Blood Urea Nitrogen (mg/dL)

English Text: Blood Urea Nitrogen (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2 to 79	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSBUSI - Blood Urea Nitrogen (mmol/L)

Variable Name: LBDSBUSI

SAS Label: Blood Urea Nitrogen (mmol/L)

English Text: Blood Urea Nitrogen (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.71 to 28.2	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSCLSI - Chloride (mmol/L)

Variable Name: LBXSCLSI

SAS Label: Chloride (mmol/L)

English Text: Chloride (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
84 to 117	Range of Values	9476	9476	
.	Missing	933	10409	

LBXSCK - Creatine Phosphokinase (CPK) (IU/L)

Variable Name: LBXSCK

SAS Label: Creatine Phosphokinase (CPK) (IU/L)

English Text: Creatine Phosphokinase (CPK) (IU/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
11 to 16959	Range of Values	9469	9469	
.	Missing	940	10409	

LBXSCR - Creatinine, refrigerated serum (mg/dL)

Variable Name: LBXSCR

SAS Label: Creatinine, refrigerated serum (mg/dL)

English Text: Creatinine, refrigerated serum (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.25 to 14.97	Range of Values	9475	9475	
.	Missing	934	10409	

LBDSCRSI - Creatinine, refrigerated serum (umol/L)

Variable Name: LBDSCRSI

SAS Label: Creatinine, refrigerated serum (umol/L)

English Text: Creatinine, refrigerated serum (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
22.1 to 1323.35	Range of Values	9475	9475	
.	Missing	934	10409	

LBXSGB - Globulin (g/dL)

Variable Name: LBXSGB

SAS Label: Globulin (g/dL)

English Text: Globulin (g/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.3 to 6	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSGBSI - Globulin (g/L)

Variable Name: LBDSGBSI

SAS Label: Globulin (g/L)

English Text: Globulin (g/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
13 to 60	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSGL - Glucose, refrigerated serum (mg/dL)

Variable Name: LBXSGL

SAS Label: Glucose, refrigerated serum (mg/dL)

English Text: Glucose, refrigerated serum (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
39 to 626	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSGLSI - Glucose, refrigerated serum (mmol/L)

Variable Name: LBDSGLSI

SAS Label: Glucose, refrigerated serum (mmol/L)

English Text: Glucose, refrigerated serum (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2.16 to 34.75	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSGTSI - Gamma Glutamyl Transferase (GGT) (IU/L)

Variable Name: LBXSGTSI

SAS Label: Gamma Glutamyl Transferase (GGT) (IU/L)

English Text: Gamma Glutamyl Transferase (GGT) (IU/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2 to 2394	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSGTLC - GGT Comment Code

Variable Name: LBDSGTLC

SAS Label: GGT Comment Code

English Text: Gamma Glutamyl Transferase (GGT) Comment Code

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above detection limit	9472	9472	
1	Below lower detection limit	1	9473	
.	Missing	936	10409	

LBXSIR - Iron, refrigerated serum (ug/dL)

Variable Name: LBXSIR

SAS Label: Iron, refrigerated serum (ug/dL)

English Text: Iron, refrigerated serum (ug/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
8 to 476	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSIRSI - Iron, refrigerated serum (umol/L)

Variable Name: LBDSIRSI

SAS Label: Iron, refrigerated serum (umol/L)

English Text: Iron, refrigerated serum (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.4 to 85.3	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSLDSI - Lactate Dehydrogenase (LDH) (IU/L)

Variable Name: LBXSLDSI

SAS Label: Lactate Dehydrogenase (LDH) (IU/L)

English Text: Lactate Dehydrogenase (LDH) (IU/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
49 to 779	Range of Values	9263	9263	
.	Missing	1146	10409	

LBXSOSSI - Osmolality (mmol/Kg)

Variable Name: LBXSOSSI

SAS Label: Osmolality (mmol/Kg)

English Text: Osmolality (mmol/Kg)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
246 to 314	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSPH - Phosphorus (mg/dL)

Variable Name: LBXSPH

SAS Label: Phosphorus (mg/dL)

English Text: Phosphorus (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.6 to 9.6	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSPHSI - Phosphorus (mmol/L)

Variable Name: LBDSPHSI

SAS Label: Phosphorus (mmol/L)

English Text: Phosphorus (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.517 to 3.1	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSKSI - Potassium (mmol/L)

Variable Name: LBXSKSI

SAS Label: Potassium (mmol/L)

English Text: Potassium (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2.6 to 7.1	Range of Values	9466	9466	
.	Missing	943	10409	

LBXSNASI - Sodium (mmol/L)

Variable Name: LBXSNASI

SAS Label: Sodium (mmol/L)

English Text: Sodium (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
121 to 151	Range of Values	9476	9476	
.	Missing	933	10409	

LBXSTB - Total Bilirubin (mg/dL)

Variable Name: LBXSTB

SAS Label: Total Bilirubin (mg/dL)

English Text: Total Bilirubin (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.1 to 3.8	Range of Values	9475	9475	
.	Missing	934	10409	

LBDSTBSI - Total Bilirubin (umol/L)

Variable Name: LBDSTBSI

SAS Label: Total Bilirubin (umol/L)

English Text: Total Bilirubin (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.71 to 64.98	Range of Values	9474	9474	
.	Missing	935	10409	

LBDSTBLC - Total Bilirubin Comment Code

Variable Name: LBDSTBLC

SAS Label: Total Bilirubin Comment Code

English Text: Total Bilirubin Comment Code

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above detection limit	9474	9474	
1	Below lower detection limit	1	9475	
.	Missing	934	10409	

LBXSCA - Total Calcium (mg/dL)

Variable Name: LBXSCA

SAS Label: Total Calcium (mg/dL)

English Text: Total Calcium (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
6.4 to 12.3	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSCASI - Total Calcium (mmol/L)

Variable Name: LBDSCASI

SAS Label: Total Calcium (mmol/L)

English Text: Total Calcium (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.6 to 3.075	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSCH - Cholesterol, refrigerated serum (mg/dL)

Variable Name: LBXSCH

SAS Label: Cholesterol, refrigerated serum (mg/dL)

English Text: Total Cholesterol, refrigerated serum (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
72 to 438	Range of Values	9475	9475	
.	Missing	934	10409	

LBDSCHSI - Cholesterol, refrigerated serum (mmol/L)

Variable Name: LBDSCHSI

SAS Label: Cholesterol, refrigerated serum (mmol/L)

English Text: Total Cholesterol, refrigerated serum (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.862 to 11.327	Range of Values	9475	9475	
.	Missing	934	10409	

LBXSTP - Total Protein (g/dL)

Variable Name: LBXSTP

SAS Label: Total Protein (g/dL)

English Text: Total Protein (g/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
4.4 to 10	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSTPSI - Total Protein (g/L)

Variable Name: LBDSTPSI

SAS Label: Total Protein (g/L)

English Text: Total Protein (g/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
44 to 100	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSTR - Triglycerides, refrig serum (mg/dL)

Variable Name: LBXSTR

SAS Label: Triglycerides, refrig serum (mg/dL)

English Text: Triglycerides, refrigerated serum (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
25 to 2923	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSTRSI - Triglycerides, refrig serum (mmol/L)

Variable Name: LBDSTRSI

SAS Label: Triglycerides, refrig serum (mmol/L)

English Text: Triglycerides, refrigerated serum (mmol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.282 to 33.001	Range of Values	9473	9473	
.	Missing	936	10409	

LBXSUA - Uric acid (mg/dL)

Variable Name: LBXSUA

SAS Label: Uric acid (mg/dL)

English Text: Uric acid (mg/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.8 to 15.1	Range of Values	9473	9473	
.	Missing	936	10409	

LBDSUASI - Uric acid (umol/L)

Variable Name: LBDSUASI

SAS Label: Uric acid (umol/L)

English Text: Uric acid (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
47.6 to 898.1	Range of Values	9473	9473	
.	Missing	936	10409	