Third National Health and Nutrition Examination Survey
(NHANES III), 1988-94

NHANES III SECOND EXAM FILE DOCUMENTATION

Series 11, No. 3A

July 1999

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Introduction

The National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC) collects, analyzes, and disseminates data on the health status of U.S. residents. The results of surveys, analyses, and studies are made known through a number of data release mechanisms including publications, mainframe computer data files, CD-ROMs (Search and Retrieval Software, Statistical Export and Tabulation System (SETS)), and the Internet.

The National Health and Nutrition Examination Survey (NHANES) is a periodic survey conducted by NCHS. The third National Health and Nutrition Examination Survey (NHANES III), conducted from 1988 through 1994, was the seventh in a series of these surveys based on a complex, multi-stage sample design. It was designed to provide national estimates of the health and nutritional status of the United States' civilian, noninstitutionalized population aged two months and older.

The following table summarizes the NHANES III data which are currently available on CD-ROM, including this release.

Table 1. Available NHANES III CD-ROMs

CD-ROM Name	Release Date	Size in Megabytes	Data Files / Description
NHANES III, 1988-94, Series 11, No. 3A, ASCII Version (this release)	July 1999	33	Second exam sample files for dietary recall, examination, laboratory, additional laboratory analytes and documentation
NHANES III, 1988-94, Series 11, No. 2A, ASCII Version	April 1998	407	Dietary recall (replacement), electrocardiography, laboratory (additional analytes), and vitamins/medicines data files and documentation
NHANES III, 1988-94, Series 11, No. 1, Revised SETS Version 1.22a	October 1997	285	Adult and youth household questionnaire, examination, and laboratory data files and documentation, plan and operation, analytic and reporting guidelines, weighting and estimation methodology, field operations, non-response bias
NHANES III, 1988-94, Series 11, No. 1A, ASCII Version	July 1997	454	Adult and youth household questionnaire, dietary recall, examination, and laboratory data files and documentation
NHANES III, 1988-94, Series 11, No. 1, SETS Version 1.22a *	July 1997	285	Adult and youth household questionnaire, examination, and laboratory data files and documentation

NHANES III Reference Manuals and Reports October 1996	October 1996	152	Plan and operation, analytic and reporting guidelines, weighting and estimation methodology, field operations, non-response bias

* Do not use this CD-ROM It had technical problems and has been superseded by the revised SETS version 1.22a, Series 11, No. 1, released in October 1997.

This CD-ROM, Series 11 No. 3A, contains data obtained from a second exam of selected survey participants who had a primary exam. This release does not replace the previous NHANES III data releases series 11 Nos. 1A and 2A).

Table 2. Location of the interview and examination components in the NHANES III public use data files

Topic	Data File						
	HA	HY	EXAM	LAB	DIET	VMS	ECG
Sample weights	X	X	X	X	.	.	X
Age/race/sex	X	X	X	X	.	.	X
Ethnic background	X	X	.	.	.	.	.
Household composition	X	X	.	.	.	.	.
Individual characteristics	X	X	.	.	.	.	.
Health insurance	X	X	.	.	.	.	.
Family background	X	X	.	.	.	.	.
Occupation of family head	X	X	.	.	.	.	.
Housing characteristics	X	X	.	.	.	.	.
Family characteristics	X	X	.	.	.	.	.
Orientation	X	X	.	.	.	.	.
Health services	X	X	.	.	.	.	.
Selected health conditions	X	X	X	.	.	.	.
Diabetes questions	X	.	.	.	.	.	.
High blood pressure and cholesterol questions	X	.	.	.	.	.	.
Cardiovascular disease questions	X	.	.	.	.	.	.
Musculoskeletal conditions	X	.	.	.	.	.	.
Physical functioning questions	X	.	.	.	.	.	.
Gallbladder disease questions	X	.	.	.	.	.	.

Table 2. (continued) Location of the interview and examination components in the NHANES III public use data files

	Data File						
Topic	HA	HY	EXAM	LAB	DIET	VMS	ECG
Kidney conditions	X	.	.	.	.	.	.
Respiratory and allergy questions	X	X	.	.	.	.	.
Diet questions	X	.	.	.	.	.	.
Food frequency	X	.	X	.	.	.	.
Vision questions	X	X	.	.	.	.	.
Hearing questions	X	X	.	.	.	.	.
Dental care and status	X	X	.	.	.	.	.
Tobacco	X	.	X	.	.	.	.
Occupation	X	.	.	.	.	.	.
Language usage	X	X	.	.	.	.	.
Exercise	X	.	.	.	.	.	.
Social support/residence	X	.	.	.	.	.	.
Vitamin/mineral/medicine usage	X	X	X	.	.	.	.
Blood pressure measurement	X	.	X	.	.	.	.
Birth	.	X	X	.	.	.	.
Infant feeding practices/diet	.	X	.	.	.	.	.
Motor and social development	.	X	.	.	.	.	.
Functional impairment	X	X	.	.	.	.	.
School attendance	.	X	.	.	.	.	.
Cognitive function	.	X	X	.	.	.	.

Table 2. (continued) Location of the interview and examination components in the NHANES III public use data files

Topic	Data File						
	HA	HY	EXAM	LAB	DIET	VMS	ECG
Alcohol and drug use	.	.	X	.	.	.	.
Reproductive health	.	.	X	.	.	.	.
Diagnostic interview schedule	.	.	X	.	.	.	.
Activity	.	.	X	.	.	.	.
Physician's examination	.	.	X	.	.	.	.
Height and weight	.	.	X	.	.	.	.
Body measurements	.	.	X	.	.	.	.
Dental examination	.	.	X	.	.	.	.
Allergy skin test	.	.	X	.	.	.	.
Audiometry	.	.	X	.	.	.	.
Tympanometry	.	.	X	.	.	.	.
WISC and WRAT	.	.	X	.	.	.	.
Spirometry	.	.	X	.	.	.	.
Bone densitometry	.	.	X	.	.	.	.
Gallbladder ultrasonography	.	.	X	.	.	.	.
Central nervous system function evaluation	.	.	X	.	.	.	.
Fundus photography	.	.	X	.	.	.	.
Physical function evaluation	.	.	X	.	.	.	.
Fasting questions	.	.	.	X	.	.	.

Table 2. (continued) Location of the interview and examination components in the NHANES III public use data files

Topic	Data File						
	HA	HY	EXAM	LAB	DIET	VMS	ECG
Laboratory tests on blood and urine	.	.	.	X	.	.	.
Total nutrient intakes	.	.	X	.	.	.	.
Individual foods	.	.	.	.	X	.	.
Combination foods	.	.	.	.	X	.	.
Ingredients	.	.	.	.	X	.	.
Prescription Medicines	X	X	.	.	.	X	.
Vitamins and Minerals	X	X	.	.	.	X	.
Electrocardiography	.	.	.	.	.	.	X

Data File Definitions

HA - Household Adult Data File
HY - Household Youth Data File
EXAM - Examination Data File
LAB - Laboratory Data File and Second Laboratory Data File
DIET - Dietary Recall Data Files
VMS - Vitamin Mineral Supplement Data File
ECG - Electrocardiography Data File

This document includes the documentation for the NHANES III Second Exam Laboratory File and also contains a general overview of the survey and the use of
the data files. The general overview includes five sections. The first section, entitled "Guidelines for Data Users," contains important information about the use of the data files. The second section, "Survey Description," is a brief overview of the survey plan and operation. The third section, "Sample Design and Analysis Guidelines," describes some technical aspects of the sampling plan and discusses some analytic issues particularly related to the use of data from complex sample surveys. The "Data Preparation and Processing Procedures" section describes the editing conventions and the codes used to represent the data. The last and fifth section, "General References," includes a reference list for the survey overview sections of the document.

Public Use Data Files for the third National Health and Nutrition Examination Survey will also be available from the National Technical Information Service (NTIS). A list of NCHS public use data tapes available for purchase from NTIS may be obtained from the Data Dissemination Branch at NCHS. Information regarding a bibliography (on disk) of journal articles

citing data from all the NHANES and the availability of NHANES III data in CD-ROM/SETS software format can be obtained from the Data Dissemination Branch at:

Data Dissemination Branch
National Center for Health Statistics
Room 1018
6525 Belcrest Road
Hyattsville, Maryland 20782

Phone: (301)458-4636

URL:http://www.cdc.gov/nchswww

NTIS can be contacted at:

NTIS - Computer Products Office
5285 Port Royal Road
Springfield, Virginia 22161
(703) 487-4807

Copies of all NHANES III questionnaires and data collection forms are included in the Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-94 (NCHS, 1994; U.S. DHHS, 1996). This publication, along with detailed information on NHANES procedures, interviewing, data collection, quality control techniques, survey design, nonresponse, and sample weighting can be found on the NHANES III Reference Manuals and Reports CD-ROM (U.S. DHHS, 1996). Information on how to order this CD-ROM is also available from the Data Dissemination Branch at NCHS at the address and telephone number given above.

NHANES III Second Exam Sample

The NHANES III Second Exam Sample was a sub-study of NHANES III, conducted for research purposes. These research files are intended to provide additional data for use with special statistical methods to improve estimates from the main survey data and for methodologic investigations. Following this description of the Second Exam Sample is information on the overall survey which is also relevant for the Second Exam Sample, including: general guidelines for data users, a description of the survey, sample design, analysis guidelines and a description of the data preparation and processing procedures.

Sample design and survey description

No statistical sampling design was applied for the second exam. However, a nonrandom sample of about five percent was obtained by selecting approximately 20
participants from the roughly 400 sample persons examined at each survey location. The following general guidelines were used by the MEC staff to select participants for the second exam:

1) select mainly adults, 2)half between the ages of 20-39 years, and half over 40 years; 3) select about half men and half women. The sample obtained consists of 2,603 persons, with 1,205 males (46 percent)and 1,398 females (54 percent).

Age group	2nd # of Exams	Percentage of 2nd Exams
< 12	212	8
12-19	231	9
20-39	809	31
40-59	578	22
> 60	773	30

The second exams were scheduled after the first or primary exams, when possible at the same time of day as the first exam. The second exams were conducted over the same time period as the primary exams for a particular survey location by the
same MEC staff, although priority was given to scheduling and completing primary exams. The second exams were administered following the same protocols as for the primary exam, with the following exceptions: the food frequency questionnaire
was not administered to adolescents 12-16 years; the WISC/WRAT was not administered to youths 6-16 years, and hand/knee x-rays were not re-administered on adults aged 60 and over.

Analytic Issues

Due to the research nature of these data, special caution should be used in

analysis. All analyses should include thorough investigation of the potential selection bias of this small non-random sub-sample. Careful attention to identifying and evaluating differences in important characteristics (e.g., age and race-ethnicity) between the subsample and the main sample should be considered along with other issues.

The second exam data can be linked to the primary exam data and the household interview data using the unique identifier (SEQN). This is necessary to obtain the demographic data for the sample. NCHS recommends that the survey design variables (e.g., sample weights) not be linked with the second exam data, since the survey design variables were created for the full sample. There are no sample weights or other design variables specifically created for the second exam sample. There are weights labeled as "replicate...weight," but these are Fay's BRR Replicate Interview Weights. These weights are to be applied to the primary exam sample, with software which uses the balanced repeated replication (BRR) method. They should not be used with the Second Exam Sample.

Because the second exams were identical to the primary exams, with the exceptions noted above, the file structure for the second exams is the same as for the primary exam files. The variable nomenclature is the same with the following important distinction: the first or primary exam variable names have a 'p' in the third position while the second or "replicate" exam variable names have a 'r' in the third position (e.g., 'BMPWT' or 'BMRWT').

GUIDELINES FOR DATA USERS

Please refer to the following important information before analyzing data.

NHANES III Background Documents

- The Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-94, (NCHS, 1994; U.S. DHHS, 1996) provides an overview of the survey and includes copies of the survey forms.

- The sample design, nonresponse, and analytic guidelines documents on the NHANES III Reference Manuals and Reports CD-ROM (U.S. DHHS, 1996) discuss the reasons that sample weights and the complex survey design should be taken into account when conducting any analysis.

- Instruction manuals, laboratory procedures, and other NHANES III reference manuals on the NHANES III Reference Manuals and Reports CD-ROM(U.S. DHHS, 1996) are also available for further information on the details of the survey.

Analytic Data Set Preparation

- Most NHANES III survey design and demographic variables are found only on the Adult and Youth Household Data Files available on the first release. In preparing a data set for analysis, other data files must be merged with either or both of these files to obtain many important analytic variables.

- All of the NHANES III public use data files are linked with the common survey participant identification number (SEQN). Merging information from multiple NHANES III data files using this variable ensures that the appropriate information for each survey participant is linked correctly.

- NHANES III public use data files do not have the same number of records on each file. The Household Questionnaire Files (divided into two files, Adult and Youth) contain more records than the Examination Data File because not everyone who was interviewed completed the examination. The Laboratory Data File contains data only for persons aged one year and older. The Individual Foods Data File based on the dietary recall has multiple records for each person rather than the one record per sample person contained in the other data files.

- For each data file, SAS program code with standard variable names and labels is provided as separate text files on the CD-ROM that contains the data files. This SAS program code can be used to create a SAS data set from the data file.

- Modifications were made to items in the questionnaires, laboratory, and examination components over the course of the survey; as a result, data may not be available for certain variables for the full six years. In addition, variables may differ by phase since some changes were implemented between phases. Users are encouraged to read the Notes

sections of this document carefully for information about changes.

- Extremely high and low values have been verified whenever possible, and numerous consistency checks have been performed. Nonetheless, users should examine the range and frequency of values before analyzing data.

- Some data were not ready for release at the time of this publication due to continued processing of the data or analysis of laboratory specimens. A listing of those data are available in the general information section of each data file.

- Confidential and administrative data are not being released to the public. Additionally, some variables have been recoded to help protect the confidentiality of the survey participants. For example, all age-related variables were recoded to 90+ years for persons who were 90 years of age and older.

- Some variable names may differ from those used in the Phase 1 NHANES III Provisional Data Release and some variables included in the Phase 1 provisional release may not appear on these files.

- Although the data files have been edited carefully, errors may be detected. Please notify NCHS staff (301-458-4636) of any errors in the data file or the documentation.

Analytic Considerations

- NHANES III (1988-94) was designed so that the survey's first three years, 1988-91, its last three years, 1991-94, and the entire six years were national probability samples. Analysts are encouraged to use all six years of survey results.

- Sample weights are available for analyzing NHANES III data. One of the following three sample weights will be appropriate for nearly all analyses: interviewed sample final weight (WTPFQX6), examined sample final weight (WTPFEX6), and mobile examination center (MEC)- and home-examined sample final weight (WTPFHX6). Choosing which of these sample weights to use in any analysis depends on the variables being used. A good rule of thumb is to use "the least common denominator" approach. In this approach, the user checks the variables of interest. The variable that was collected on the smallest number of persons is the "least common denominator," and the sample weight that applies to that variable is the appropriate one to use for that analysis. For more detailed information, see the Analytic and Reporting Guidelines for NHANES III (U.S. DHHS, 1996).

Referencing or Citing NHANES III Data

- In publications, please acknowledge NCHS as the original data source. For instance, the reference for the NHANES III Laboratory Data File on this CD-ROM is:

  U.S. Department of Health and Human Services (DHHS). National Center for Health Statistics. Third National Health and Nutrition

Examination Survey, 1988-1994, NHANES III Second Laboratory Data File (CD-ROM, Series 11, No. 3A). Hyattsville, MD.: Centers for Disease Control and Prevention, 1999.

- Please place the acronym "NHANES III" in the titles or abstracts of journal articles and other publications in order to facilitate the retrieval of such materials in bibliographic searches.

SURVEY DESCRIPTION

The third National Health and Nutrition Examination Survey (NHANES III) was the seventh in a series of large health examination surveys conducted in the United States beginning in 1960. Three of these surveys, the National Health Examination Surveys (NHES), were conducted in the 1960's (NCHS, 1965; NCHS, 1967; NCHS, 1969). In 1970, an expanded nutrition component was added to provide data with which to assess nutritional status and dietary practices, and the name was changed to the National Health and Nutrition Examination Survey (Miller, 1973; Engel, 1978; McDowell, 1981). A special survey of Hispanic populations in the United States was conducted during 1982-1984 (NCHS, 1985).

The general structure of the NHANES III sample design was similar to that of the previous NHANES. All of the surveys used complex, multi-stage, stratified, clustered samples of civilian, noninstitutionalized populations. NHANES III was the first NHANES without an upper age limit; in fact, the age range for the survey was two months and older. A home examination option was employed for the first time in order to obtain examination data for very young children and for elderly persons who were unable to visit the mobile examination center (MEC). The home examination included only a subset of the components used in the full MEC examination since it would have been difficult to collect some types of data in a home setting. A detailed description of design specifications and copies of the data collection forms can be found in the Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-1994 (NCHS, 1994; U.S. DHHS, 1996).

NHANES III was conducted from October 1988 through October 1994 in two phases, each of which comprised a national probability sample. The first phase was conducted from October 18, 1988, through October 24, 1991, at 44 locations. The second phase was conducted from September 20, 1991, through October 15, 1994, at 45 different locations. In NHANES III, 39,695 persons were selected over the six years; of those, 33,994 (86%) were interviewed in their homes. All interviewed persons were invited to the MEC for a medical examination. Seventy-eight percent (30,818) of the selected persons were examined in the MEC, and an additional 493 persons were given a special, limited examination in their homes.

Data collection began with a household interview. Several questionnaires were administered in the household: Household Screener Questionnaire, Family Questionnaire, Household Adult Questionnaire, and Household Youth Questionnaire.

At the MEC, an examination was performed, and five automated questionnaires or interviews were administered: MEC Adult Questionnaire, MEC Youth Questionnaire, MEC Proxy Questionnaire, 24-Hour Dietary Recall, and Dietary Food Frequency (ages 12-16 years). The health examination component included a variety of tests and procedures. The examinee's age at the time of the interview and other factors determined which procedures were administered. Blood and urine specimens were obtained, and a number of tests and measurements were performed including body measurements, spirometry, fundus photography, x-rays, electrocardiography, allergy and glucose tolerance tests, and ultrasonography. Measurements were taken of bone density, hearing, and physical, cognitive, and central nervous system

functions. A physician performed a limited standardized medical examination and a dentist performed a standardized dental examination. While some of the blood and urine analyses were performed in the MEC laboratory, most analyses were conducted elsewhere by contract laboratories.

A home examination was conducted for those sample persons aged 2-11 months and aged 20 years or older who were unable to visit the mobile examination center. The home examination consisted of an abbreviated version of the tests and interviews performed in the MEC. Depending on age of the sample person, the components included body measurements, blood pressure, spirometry, venipuncture, physical function evaluation, and a questionnaire to inquire about infant feeding, selected health conditions, cognitive function, tobacco use, and reproductive history.

SAMPLE DESIGN AND ANALYSIS GUIDELINES

Sample Design

The general structure of the NHANES III sample design is the same as that of the previous NHANES. Each of these surveys used a stratified, multi-stage probability design. The major design parameters of the two previous NHANES and the special Hispanic HANES, as well as NHANES III, have been previously summarized (Miller, 1973; McDowell, 1981; NCHS, 1985; NCHS, 1994). The NHANES III sample was designed to be self-weighting within a primary sampling unit (PSU) for subdomains (age, sex, and race-ethnic groups). While the sample was fairly close to self-weighting nationally for each of these subdomain groups, it was not representative of the total population, which includes institutionalized, non-civilian persons that were outside the scope of the survey.

The NHANES III sample represented the total civilian, noninstitutionalized population, two months of age or over, in the 50 states and the District of Columbia of the United States. The first stage of the design consisted of selecting a sample of 81 PSU's that were mostly individual counties. In a few cases, adjacent counties were combined to keep PSU's above a minimum population size. The PSU's were stratified and selected with probability proportional to size (PPS). Thirteen large counties (strata) were chosen with certainty (probability of one). For operational reasons, these 13 certainty PSU's were divided into 21 survey locations. After the 13 certainty strata were designated, the remaining PSU's in the United States were grouped into 34 strata, and two PSU's were selected per stratum (68 survey locations). The selection was done with PPS and without replacement. The NHANES III sample therefore consists of 81 PSU's or 89 locations.

The 89 locations were randomly divided into two groups, one for each phase. The first group consisted of 44 and the other of 45 locations. One set of PSU's was allocated to the first three-year survey period (1988-91) and the other set to the second three-year period (1991-94). Therefore, unbiased estimates (from the point of view of sample selection) of health and nutrition characteristics can be independently produced for both Phase 1 and Phase 2 as well as for both phases combined.

For most of the sample, the second stage of the design consisted of area segments composed of city or suburban blocks, combinations of blocks, or other area segments in places where block statistics were not produced in the 1980 Census. In the first phase of NHANES III, the area segments were used only for a sample of persons who lived in housing units built before 1980. For units built in 1980 and later, the second stage consisted of sets of addresses selected from building permits issued in 1980 or later. These are referred to as "new construction segments." In the second phase, 1990 Census data and maps were used to define the area segments. Because the second phase followed within a few years of the 1990 Census, new construction did not account for a significant part of the sample, and the entire sample came from the area segments.

The third stage of sample selection consisted of households and certain types of group quarters, such as dormitories. All households and eligible

group quarters in the sample segments were listed, and a subsample was designated for screening to identify potential sample persons. The subsampling rates enabled production of a national, approximately equal-probability sample of households in most of the United States with higher rates for the geographic strata with high Mexican-American populations. Within each geographic stratum, there was a nearly equal-probability sample of households across all 89 stands.

Persons within the sample of households or group quarters were the fourth stage of sample selection. All eligible members within a household were listed, and a subsample of individuals was selected based on sex, age, and race or ethnicity. The definitions of the sex, age, race or ethnic classes, subsampling rates, and designation of potential sample persons within screened households were developed to provide approximately self-weighting samples for each subdomain within geographic strata and at the same time to maximize the average number of sample persons per sample household. Previous NHANES indicated that this increased the overall participation rate. Although the exact sample sizes were not known until data collection was completed, estimates were made. Below is a summary of the sample sizes for the full six-year NHANES III at each stage of selection:

Number of PSU's	81
Number of stands (survey locations)	89
Number of segments	2,144
Number of households screened	93,653
Number of households with sample persons	19,528
Number of designated sample persons	39,695
Number of interviewed sample persons	33,994
Number of MEC-examined sample persons	30,818
Number of home-examined sample persons	493

More detailed information on the sample design and weighting and estimation procedures for NHANES III can be found in the Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-94 (NCHS, 1994; U.S. DHHS, 1996) and in the Analytic and Reporting Guidelines: Third National Health and Nutrition Examination Survey (NHANES III), 1988-94 (U.S. DHHS, 1996).

Analysis Guidelines

Because of the complex survey design used in NHANES III, traditional methods of statistical analysis based on the assumption of a simple random sample are not applicable. Detailed descriptions of this issue and possible analytic methods for analyzing NHANES data have been described earlier (NCHS, 1985; Yetley, 1987; Landis, 1982; Delgado, 1990). Recent analytic and reporting guidelines that should be used for most NHANES III analyses and publications are contained in Analytic and Reporting Guidelines (U.S. DHHS, 1996). These recommendations differ slightly from those used by analysts for previous NHANES surveys. These suggested guidelines provide a framework to users for producing estimates that conform to the analytic design of the survey. All users are strongly urged to review these analytic and reporting guidelines before beginning any analyses of NHANES III data.

It is important to remember that this set of statistical guidelines is not absolute. When conducting analyses, the analyst needs to use his/her subject matter knowledge (including methodological issues) as well as

information about the survey design. The more one deviates from the original analytic categories defined in the sample design, the more important it is to evaluate the results carefully and to interpret the findings cautiously.

In NHANES III, 89 survey locations were randomly divided into two sets or phases, the first consisting of 44 and the other of 45 locations. One set of PSU's was allocated to the first three-year survey period (1988-91) and the other set to the second three-year period (1991-94). Therefore, unbiased national estimates of health and nutrition characteristics can be independently produced for each phase as well as for both phases combined. Computation of national estimates from both phases combined (i.e., total NHANES III) is the preferred option; individual phase estimates may be highly variable. In addition, individual phase estimates are not statistically independent. It is also difficult to evaluate whether differences in individual phase estimates are real or due to methodological differences. That is, differences may be due to changes in sampling methods or data collection methodology over time. At this time, there is no valid statistical test for examining differences between Phase 1 and Phase 2. Therefore, although point estimates can be produced separately for each phase, no test is available to test whether those estimates are significantly different from each other.

NHANES III is based on a complex, multi-stage probability sample design. Several aspects of the NHANES design must be taken into account in data analysis, including the sample weights and the complex survey design. Appropriate sample weights are needed to estimate prevalence, means, medians, and other statistics. Sample weights are used to produce correct population estimates because each sample person does not have the same probability of selection. The sample weights incorporate the differential probabilities of selection and include adjustments for noncoverage and nonresponse. A detailed discussion of nonresponse adjustments and issues related to survey coverage have been published (U.S. DHHS, 1996). With the large oversampling of young children, older persons, black persons, and Mexican-Americans in NHANES III, it is essential that the sample weights be used in all analyses. Otherwise, a misinterpretation of results is highly likely. Other aspects of the design that must be taken into account in data analyses are the strata and PSU pairings from the sample design. These pairings should be used to estimate variances and test for statistical significance. For weighted analyses, analysts can use special computer software packages that use an appropriate method for estimating variances for complex samples such as SUDAAN (Shah, 1995) and WesVarPC (Westat, 1996).

Although initial exploratory analyses may be performed on unweighted data using standard statistical packages and assuming simple random sampling, final analyses should be done on weighted data using appropriate sample weights. A summary of the weighting methodology and the type of sample weights developed for NHANES III is included in Weighting and Estimation Methodology (U.S. DHHS, 1996).

The purpose of weighting the sample data is to permit analysts to produce estimates of statistics that would have been obtained if the entire sampling frame (the United States) had been surveyed. Sample weights can be considered as measures of the number of persons the particular sample

observation represents. Weighting takes into account several features of the survey: the specific probabilities of selection for the individual domains that were oversampled as well as nonresponse and differences between

the sample and the total U.S. population. Differences between the sample and the population may arise due to sampling variability, differential undercoverage in the survey among demographic groups, and possibly other types of response errors, such as differential response rates or misclassification errors. Sample weighting in NHANES III was used to:

1. Compensate for differential probabilities of selection among subgroups (i.e., age-sex-race-ethnicity subdomains where persons living in different geographic strata were sampled at different rates);
2. Reduce biases arising from the fact that nonrespondents may be different from those who participate;
3. Bring sample data up to the dimensions of the target population totals;
4. Compensate, to the extent possible, for inadequacies in the sampling frame (resulting from omissions of some housing units in the listing of area segments, omissions of persons with no fixed address, etc.); and
5. To reduce variances in the estimation procedure by using auxiliary information that is known with a high degree of accuracy.

In NHANES III, the sample weighting was carried out in three stages. The first stage involved the computation of weights to compensate for unequal probabilities of selection (objective 1, above). The second stage adjusted for nonresponse (objective 2). The third stage used poststratification of the sample weights to Census Bureau estimates of the U.S. population to accomplish the third, fourth, and fifth objectives simultaneously. In NHANES III, several types of sample weights (see the sample weights table that follows) were computed for the interviewed and examined sample and are included in the NHANES III data file. Also, sample weights were computed separately for Phase 1 (1988-91), Phase 2 (1991-94), and total NHANES III (1988-94) to facilitate analysis of items collected only in Phase 1, only in Phase 2, and over six years of the survey. Three sets of pseudo strata and PSU pairings are provided to use with SUDAAN in variance estimation. Since NHANES III is based on a complex, multi-stage sample design, appropriate sample weights should be used in analyses to produce national estimates of prevalence and associated variances while accounting for unequal probability of selection of sample persons. For example, the final interview weight, WTPFQX6, should be used for analysis of the items or questions from the family or household questionnaires, and the final MEC examination weight, WTPFEX6, should be used for analysis of the questionnaires and measurements administered in the MEC. Furthermore, for a combined analysis of measurements from the MEC examinations and associated medical history questions from the household interview, the final MEC examination weight, WTPFEX6, should be used. We recommend using SUDAAN (Shah, 1995) to estimate statistics of interest and the associated variance. However, one can also use other published methods for variance estimation. Application of SUDAAN and alternative methods, such as the average design effect approach, balance repeated replication (BRR) methods, or jackknife methods for variance estimation, are discussed in Weighting and Estimation Methodology (U.S. DHHS, 1996).

Appropriate Uses of the NHANES III Sample Weights

Final interview weight, WTPFQX6

Use only in conjunction with the sample interviewed at home and with items collected during the household interview.

Final examination (MEC only) weight, WTPFEX6

Use only in conjunction with the MEC-examined sample and with interview and examination items collected at the MEC.

Final MEC+home examination weight, WTPFHX6

Use only in conjunction with the MEC+home-examined sample and with items collected at both the MEC and home.

Final allergy weight, WTPFALG6

Use only in conjunction with the allergy subsample and with items collected as part of the allergy component of the exam.

Final CNS weight, WTPFCNS6

Use only in conjunction with the CNS subsample and with items collected as part of the CNS component of the exam.

Final morning examination (MEC only) subsample weight, WTPFSD6

Use only in conjunction with the MEC-examined persons assigned to the morning subsample and only with items collected in the MEC exam.

Final afternoon/evening examination (MEC only) subsample weight, WTPFMD6

Use only in conjunction with the MEC-examined persons assigned to the afternoon/evening subsample and only with items collected in the MEC exam.

Final morning examination (MEC+home) subsample weight, WTPFHSD6

Use only in conjunction with the MEC- and home-examined persons assigned to the morning subsample and with items collected during the MEC and home examinations.

Final afternoon/evening examination (MEC+home) weight, WTPFHMD6

Use only in conjunction with the MEC- and home-examined persons assigned to the afternoon/evening subsample and with items collected during the MEC and home examinations.

DATA PREPARATION AND PROCESSING PROCEDURES

Automated data collection procedures for the survey were introduced in NHANES III. In the mobile examination centers, data for the interview and examination components were recorded directly onto a computerized data collection form. With the exception of a few independently automated systems, the system was centrally integrated. This operation allowed for ongoing monitoring of much of the data. Before the introduction of the computer-assisted personal interview (CAPI), the household questionnaire data were reviewed manually by field editors and interviewers. CAPI (1992-1994 only) questionnaires featured built-in edits to prevent entering inconsistencies and out-of-range responses. The multi-level data collection and quality control systems are discussed in detail in the Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-1994 (NCHS, 1994; U.S. DHHS, 1996). All interview, laboratory, and examination data were sent to NCHS for final processing.

Guidelines were developed that provided standards for naming variables, filling missing values and coding conventional responses, handling missing records, and standardizing two-part quantity/unit questionnaire variables. NCHS staff, assisted by contract staff, developed data editing specifications that checked data sets for valid codes, ranges, and skip pattern consistencies and examined the consistency of values between interrelated variables. Comments, collected in both interviews and examination components, were reviewed and recoded when possible. Responses to "Other" and "Specify" were recoded either to existing code categories or to new categories. The documentation for each data set includes notes for those variables that have been recoded and standardized and for those variables that differ significantly from what appears in the original data collection instrument. While the data have undergone many quality control and editing procedures, there still may be values that appear extreme or illogical. Values that varied considerably from what was expected were examined by analysts who checked for comments or other responses that might help to clarify unusual values. Generally, values were retained unless they could not possibly be true, in which case they were changed to "Blank but applicable." Therefore, the user must review each data set for extreme or inconsistent values and determine the status of each value for analysis.

Several editing conventions were used in the creation of final analytic data sets:

1. Standardized variables were created to replace all two-part quantity/unit questions using standard conversion factors. Standardized variables have the same name as the variable of the two-part question with an "S" suffix. For instance, MAPF18S (Months received WIC benefits) in the MEC Adult Questionnaire was created from the two-part response option to question F18, "How long did you receive benefits from the WIC program?," using the conversion factor 12 months per year.

2. Recoded variables were created by combining responses from two or more like variables, or by collapsing responses to create a summary variable for the purpose of confidentiality. Recoded variables have the original variable name with an R suffix. For example, place of birth

variable (HFA6X) in the Family Questionnaire was collapsed to a three level response category (U.S., Mexico, Other) and renamed HFA6XR. Generally, only the recoded variable has been included in the data file.

3. Fill values, a series of one or more digits, were used to represent certain specific conditions or responses. Below is a list of the fill values that were employed. Some of the fill values pertain only to questionnaire data, although 8-fill and blank-fill values are found in all data sets. Other fill values, not included in this list, are used to represent component-specific conditions.

   6-fills = Varies/varied. (Questionnaires only)

   7-fills = Fewer than the smallest number that could be reported within the question structure (e.g., fewer than one cigarette per day). (Questionnaires only)

   8-fills = Blank but applicable/cannot be determined. This means that a respondent was eligible to receive the question, test, or component but did not because of refusal, lack of time, lack of staff, loss of data, broken vial, language barrier, unreliability, or other similar reasons.

   9-fills = Don't know. This fill was used only when a respondent did not know the response to a question and said, "I don't know." (Questionnaires only)

   Blank fills = Inapplicable. If a respondent was not eligible for a questionnaire, test, or component because of age, gender, or specific reason, the variable was blank-filled. In the questionnaire, if a respondent was not asked a question because of a skip-pattern, variables corresponding to the question were blank-filled. For examination or laboratory components, if a person was excluded by a defined protocol (e.g., screening exclusion questions) and these criteria are included in the data set, then the corresponding variables were blank-filled for that person. For home examinees, variables for examination components and blood tests not performed as part of the home examination protocol were blank-filled.

4. For variables describing discrete data, codes of zero (0) were used to mean "none," "never," or the equivalent. Value labels for which "0" is used include: "has not had," "never regularly," "still taking," or "never stopped using." Unless otherwise labeled, for variables containing continuous data, "zero" means "zero.

5. Where there are logical skip patterns in the flow of the questionnaire or examination component, the skip was indicated by placing the variable label of the skip destination in parentheses as part of the value label of the response generating the skip. For example, in the Physical Function Evaluation, the variable PFPWC (in wheelchair) has a value label, "2 No (PFPSCOOT)" that means that the next item for persons not in a wheelchair would be represented by the variable, PFPSCOOT.

Variable Nomenclature

A unique name was assigned to every NHANES III variable using a standard convention. By following this naming convention, the origin of each variable is clear, and there is no chance of overlaying similar variables across multiple components. Variables range in length from three to eight characters. The first two variable characters represent the topic (e.g., analyte, questionnaire instrument, examination component) and are listed below alphabetically by topic. For questionnaires administered in the household, the remainder of the variable name following the first two characters indicates the question section and number. For example, data for the response to the Household Adult Questionnaire question B1 are contained in the variable HAB1. For most laboratory and examination variables, as well as some other variables, a "P" in the third position refers to "primary" and the remainder of the variable name is a brief description of the item. For instance, in the Laboratory Data File, information on the length of time the person fasted before the first blood draw is contained in the variable PHPFAST. The variable PHPFAST was derived as follows: characters 1-2 (PH) refer to "phlebotomy," character 3 (P) refers to "primary," characters 4-8 (FAST) refer to an abbreviation for "fasting."

CODE	TOPIC
AT	Alanine aminotransferase (from biochemistry profile)
AM	Albumin (from biochemistry profile)
AP	Alkaline phosphatase (from biochemistry profile)
AL	Allergy skin test
AC	Alpha carotene
AN	Anisocytosis
TM	Antimicrosomal antibodies
TA	Antithyroglobulin antibodies
AA	Apolipoprotein (AI)
AB	Apolipoprotein (B)
AS	Aspartate aminotransferase (from biochemistry profile)
LA	Atypical lymphocyte
AU	Audiometry
BA	Band
BO	Basophil
BS	Basophilic stippling
BC	Beta carotene
BX	Beta cryptoxanthin
BL	Blast
BU	Blood urea nitrogen (BUN) (from biochemistry profile)
BM	Body measurements
BD	Bone densitometry
C1	C-peptide (first venipuncture)
C2	C-peptide (second venipuncture)
CR	C-reactive protein
UD	Cadmium
CN	Central nervous system function evaluation
CL	Chloride (from biochemistry profile)
CO	Cotinine
CE	Creatinine (serum)(from biochemistry profile)
UR	Creatinine (urine)

CODE	TOPIC
DM	Demographic
DE	Dental examination
MQ	Diagnostic interview schedule
DR	Dietary recall (total nutrient intakes)
EO	Eosinophil
EP	Erythrocyte protoporphyrin
FR	Ferritin
FB	Fibrinogen
RB	Folate (RBC)
FO	Folate (serum)
FH	Follicle stimulating hormone (FSH)
FP	Fundus photography
GG	Gamma glutamyl transferase (GGT) (from biochemistry profile)
GU	Gallbladder ultrasonography
GB	Globulin (from biochemistry profile)
G1	Glucose (first venipuncture)
G2	Glucose (second venipuncture)
SG	Glucose (from biochemistry profile)
GH	Glycated hemoglobin
GR	Granulocyte
C3	HCO3 (Bicarbonate)(from biochemistry profile)
HD	HDL cholesterol
HP	Helicobacter pylori antibody
HT	Hematocrit
HG	Hemoglobin
AH	Hepatitis A antibody (HAV)
HB	Hepatitis B core antibody (anti-HBc)
SS	Hepatitis B surface antibody (anti-HBs)
SA	Hepatitis B surface antigen (HBsAg)
HC	Hepatitis C antibody (HCV)
DH	Hepatitis D antibody (HDV)
H1	Herpes 1 antibody
H2	Herpes 2 antibody
HX	Home examination (general)
HO	Homocysteine
HF	Household family questionnaire
HA	Household adult questionnaire
HQ	Household questionnaire variables (composite)
HS	Household screener questionnaire
HY	Household youth questionnaire
HZ	Hypochromia
I1	Insulin (first venipuncture)
I2	Insulin (second venipuncture)
UI	Iodine (urine)
FE	Iron
SF	Iron (from biochemistry profile)
LD	Lactate dehydrogenase (from biochemistry profile)
L1	Latex antibody
LC	LDL cholesterol (calculated)
PB	Lead
LP	Lipoprotein (a)
LH	Luteinizing hormone

CODE	TOPIC
LU	Lutein/zeaxanthin
LY	Lycopene
LM	Lymphocyte
MR	Macrocyte
MC	Mean cell hemoglobin (MCH)
MH	Mean cell hemoglobin concentration (MCHC)
MV	Mean cell volume (MCV)
PV	Mean platelet volume
MA	MEC adult questionnaire
MX	MEC examination (general)
FF	Dietary food frequency (ages 12-16 years)
MP	MEC proxy questionnaire
MY	MEC youth questionnaire
ME	Metamyelocyte
MI	Microcyte
MO	Monocyte
MN	Mononuclear cell
ML	Myelocyte
IC	Normalized calcium (derived from ionized calcium)
OS	Osmolality (from biochemistry profile)
PH	Phlebotomy data collected in MEC (e.g., questions)
PS	Phosphorus (from biochemistry profile)
PF	Physical function evaluation
PE	Physician's examination
PL	Platelet
DW	Platelet distribution width
PK	Poikilocytosis
PO	Polychromatophilia
SK	Potassium (from biochemistry profile)
PR	Promyelocyte
RC	Red blood cell count (RBC)
RW	Red cell distribution width (RDW)
RE	Retinyl esters
RF	Rheumatoid factor antibody
RU	Rubella antibody
WT	Sample weights
SE	Selenium
SI	Sickle cell
NA	Sodium (from biochemistry profile)
SH	Spherocyte
SP	Spirometry
SD	Survey design
TT	Target cell
TE	Tetanus
TH	Thyroid Stimulating Hormone (TSH)
T4	Thyroxine
TB	Total bilirubin (from biochemistry profile)
CA	Total calcium
SC	Total calcium (from biochemistry profile)
TC	Total cholesterol
CH	Total cholesterol (from biochemistry profile)
TI	Total iron binding capacity (TIBC)
TP	Total protein (from biochemistry profile)
TX	Toxic granulation

CODE	TOPIC
TO	Toxoplasmosis antibody
PX	Transferrin saturation
TG	Triglycerides
TR	Triglycerides (from biochemistry profile)
TY	Tympanometry
UA	Uric acid (from biochemistry profile)
UB	Urinary albumin
VU	Vacuolated cells
VR	Varicella antibody
VA	Vitamin A
VB	Vitamin B12
VC	Vitamin C
VD	Vitamin D
VE	Vitamin E
WC	White blood cell count (WBC)
WW	WISC/WRAT cognitive test

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NHANES III LABORATORY DATA FILE

Introduction

This documentation presents information that should be reviewed before proceeding with data analysis.

The documentation for this laboratory data file is divided into four main sections. The first section, "General Information," provides information about the contents of the data file. The second section, "Data File Index," includes a brief description of all the variables on the data set and shows the standard name of each variable and its position in the data set. The third section, "Item Descriptions, Codes, Counts, and Notes" provides a description for each component, the standard variable name and a brief description of the values that variable can take on, a count of the frequency of occurrence of each value, notes by variable and appendices as necessary. "References" are provided in the fourth section.

Blood specimens were collected on examinees aged one year and older at the mobile examination center (MEC). For those examinees aged one year and older who did not travel to the MEC, a home examination was conducted. Only a limited number of tests were performed on specimens collected during the Home Examination. Appendix 1 lists the laboratory tests by specimen type, age group, sex, and whether the specimen was collected in the Home Examination.

The analysis of NHANES III laboratory data must be conducted with the key survey design and basic demographic variables. Other released files may be linked to the Second Laboratory Data File using the unique survey participant (sample person) identifier SEQN.

Examinee Screening

Prior to the phlebotomy, a questionnaire was administered to determine an examinee's eligibility for all phlebotomy procedures (including venipuncture and the oral glucose tolerance test). It included questions to determine if it was safe to perform the venipuncture, to document and determine fasting compliance and to aid in analyzing the results of the laboratory tests performed. Examinees reporting hemophilia or recent cancer chemotherapy treatment were excluded from the venipuncture. For those examinees, the laboratory test results fields for all blood-based laboratory tests were left blank.

Although examinees aged 12 years and older were instructed to fast for 10-16 hours prior to the morning examination or for six hours before the afternoon or evening examination, the instructions were not followed uniformly. Laboratory test results and the duration of the fast have been included on the data file regardless of the examinee's fasting compliance. Analysts should consider whether fasting status is crucial before undertaking analyses. Examinees who reported insulin use during the household interview were not instructed to fast.

Specimen Collection and Processing Procedures

Detailed specimen collection and processing instructions are discussed in the Manual for Medical Technicians (U.S. DHHS, 1996). Vials were stored under appropriate refrigerated (4-8 degrees Centigrade) or frozen (-20 degrees Centigrade) conditions until they were shipped to analytical laboratories for testing. The analytical methods used by each of the participating laboratories are described in the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996). The manual contains quality control graphs and statistical summary information for each laboratory test at the end of the laboratory method description.

Examiner Training and Quality Control

The NHANES III laboratory staff consisted of medical technologists and phlebotomists. The medical technologists held baccalaureates in medical technology. Both they and the phlebotomists were certified by the American Society for Clinical Pathologists or by a similar organization.

All laboratory staff completed comprehensive training in standardized laboratory procedures before they began working in the MEC. The MEC phlebotomists completed comprehensive training in pediatric phlebotomy techniques, including instruction by a pediatric nurse practitioner. Laboratory team performance was monitored using several techniques. NCHS and contract consultants used a structured quality assurance evaluation during unscheduled visits to evaluate both the quality of the laboratory work and the quality-control procedures. Each laboratory staff person was observed for equipment operation, specimen collection and preparation, and testing procedures, and constructive feedback was given to each team. Formal retraining sessions were conducted annually to ensure that required skill levels were maintained.

Laboratory Protocol Changes from 1988 to 1994

Most laboratory tests were performed for the entire six years of NHANES III. For statistical analyses of these laboratory test results, the appropriate six-year sample weight should be used.

Data Preparation and Processing

Results from urine pregnancy tests are included in the NHANES III Examination Data File, rather than in the Laboratory Data File.

For laboratory tests with a lower detection limit, results below the lower detection limit were replaced with a value equal to the detection limit divided by the square root of two. This value was created to help the user distinguish a nondetectable laboratory test result from a measured laboratory test result. Appendix 2 documents the detection limit for each laboratory test.

The SI unit (le Systeme International d Unites) is an outgrowth of the metric system that has been used throughout most of the world. In addition to providing a uniform international system of units of measurement, a uniform style is prescribed. Laboratory test results not originally reported in SI units were converted to SI units if applicable. Conversion factors, the format of the NHANES and SI results, and NHANES and SI units of measure are in Appendix 3. In converting NHANES III data to SI units, the goal was to preserve the level of detail reported by the laboratories in the original laboratory test result. Therefore, the number of significant digits in the laboratory test results data may be different from that in published references.

NHANES III Laboratory Data File Index
Whole Blood, Serum, Plasma, and Urine Data

Description	Variable Name	Positions
GENERAL INFORMATION		
Respondent identification number	SEQN	1-5
Session for MEC examination	MXRSESSR	6
Date of repl. MEC exam time in: month	MXRTIMO	7-8
Number of days between exams	MXPRDAYS	9-10
SECOND EXAM DATA		
PHLEBOTOMY SCREENING QUESTIONNAIRE		
Language RP	PHRLANG	11
Do you have hemophilia? RP	PHRHEMO	12
Recent chemo/within the past 4 wks RP	PHRCHM2	13
Are you currently taking insulin? RP	PHRINSU	14
Time participant last ate RP	PHRSNTI	15-19
Day participant last ate RP	PHRSNDA	20
Have you had anything to drink? RP	PHRDRIN	21
Time participant last drank RP	PHRDRTI	22-26
Day participant last drank RP	PHRDRDA	27
Length of calculated fast (in hours) RP	PHRFAST	28-32
Time of venipuncture RP	PHRBEST	33-37
SECOND EXAM DATA		
HEMATOLOGY		
White blood cell count RP	WCR	38-42
White blood cell count: SI RP	WCRSI	43-47
Lymphocyte percent (Coulter) RP	LMRPCNT	48-52
Mononuclear percent (Coulter) RP	MORPCNT	53-57
Granulocyte percent (Coulter) RP	GRRPCNT	58-62
Lymphocyte number (Coulter) RP	LMR	63-66
Mononuclear number (Coulter) RP	MOR	67-70
Granulocyte number (Coulter) RP	GRR	71-75
Red blood cell count RP	RCR	76-79
Red blood cell count: SI RP	RCRSI	80-83
Hemoglobin (g/dL) RP	HGR	84-88
Hemoglobin: SI (g/L) RP	HGRSI	89-93
Hematocrit (%) RP	HTR	94-98
Hematocrit: SI (L/L=1) RP	HTRSI	99-103

NHANES III Laboratory Data File Index
Whole Blood, Serum, Plasma, and Urine Data

Description	Variable Name	Positions
Mean cell volume: SI (fL) RP	MVRSI	104-108
Mean cell hemoglobin: SI (pg) RP	MCRSI	109-113
Mean cell hemoglobin conc (g/dL) RP	MHR	114-118
M cell hemoglobin conc: SI (g/L) RP	MHRSI	119-123
Red cell distribution width (%) RP	RWR	124-128
Red cell distr width: SI (fraction) RP	RWRSI	129-134
Platelet count RP	PLR	135-139
Platelet count: SI RP	PLRSI	140-144
Platelet distribution width (%) RP	DWR	145-149
Mean platelet volume: SI (fL) RP	PVRSI	150-154
Seg neutrophils (pct of 100 cells) RP	GRRDIF	155-157
Lymphocytes (percent of 100 cells) RP	LMRDIF	158-160
Monocytes (percent of 100 cells) RP	MORDIF	161-162
Eosinophils (percent of 100 cells) RP	EOR	163-164
Basophils (percent of 100 cells) RP	BOR	165
Blasts (percent of 100 cells) RP	BLR	166
Promyelocytes (percent of 100 cells) RP	PRR	167
Metamyelocytes (percent of 100 cells) RP	MER	168
Myelocytes (percent of 100 cells) RP	MLR	169
Bands (percent of 100 cells) RP	BAR	170-171
Atyp lymphocytes (pct of 100 cells) RP	LAR	172-173
Anisocytosis (variation of cell size) RP	ANR	174
Basophilic stippling RP	BSR	175
Hypochromia (stain intensity of cell) RP	HZR	176
Poikilocytosis (cell shape variation) RP	PKR	177
Polychromatophilia (bluish color) RP	POR	178
Macrocytosis (large cell prevalence) RP	MRR	179
Microcytosis (small cell prevalence) RP	MIR	180
Sickle cells RP	SIR	181
Spherocytosis RP	SHR	182
Target cells RP	TTR	183
Toxic granulation RP	TXR	184
Vacuolated cells RP	VUR	185

SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Lead (ug/dL) RP	PBR	186-189
Lead: SI (umol/L) RP	PBRSI	190-194

NHANES III Laboratory Data File Index
Whole Blood, Serum, Plasma, and Urine Data

Description	Variable Name	Positions
Protoporphyrin (ug/dL RBC) RP	EPR	195-198
Protoporphyrin: SI (umol/L RBC) RP	EPRSI	199-203
Serum iron (ug/dL) RP	FER	204-206
Serum iron: SI (umol/L) RP	FERSI	207-211
Serum TIBC (ug/dL) RP	TIR	212-215
Serum TIBC: SI (umol/L) RP	TIRSI	216-221
Transferrin saturation (%) RP	PXR	222-225
Serum ferritin (ng/mL) RP	FRR	226-229
Serum ferritin: SI (ug/L) RP	FRRSI	230-233
Serum folate (ng/mL) RP	FOR	234-237
Serum folate: SI (nmol/L) RP	FORSI	238-242
RBC folate (ng/mL) RP	RBR	243-246
RBC folate: SI (nmol/L) RP	RBRSI	247-252
Serum vitamin B12 (pg/mL) RP	VBR	253-257
Serum vitamin B12: SI (pmol/L) RP	VBRSI	258-265
Serum vitamin C (mg/dL) RP	VCR	266-269
Serum vitamin C: SI (mmol/L) RP	VCRSI	270-275
Serum normalized calcium: SI (mmol/L) RP	ICRSI	276-279
Serum total calcium: SI (mmol/L) RP	CARSI	280-283
Serum selenium (ng/mL) RP	SER	284-286
Serum selenium: SI (nmol/L) RP	SERSI	287-290
Vitamin A (ug/dL) RP	VAR	291-293
Serum vitamin A: SI (umol/L) RP	VARSI	294-297
Serum vitamin E (ug/dL) RP	VER	298-302
Serum vitamin E: SI (umol/L) RP	VERSI	303-308
Serum alpha carotene (ug/dL) RP	ACR	309-311
Serum alpha carotene: SI (umol/L) RP	ACRSI	312-315
Serum beta carotene (ug/dL) RP	BCR	316-318
Serum beta carotene: SI (umol/L) RP	BCRSI	319-322
Serum beta cryptoxanthin (ug/dL) RP	BXR	323-325
Serum beta cryptoxanthin: SI (umol/L) RP	BXRSI	326-329
Serum lutein/zeaxanthin (ug/dL) RP	LUR	330-332
Serum lutein/zeaxanthin: SI (umol/L) RP	LURSI	333-336
Lycopene (ug/dL) RP	LYR	337-339
Serum lycopene: SI (umol/L) RP	LYRSI	340-343
Serum sum retinyl esters (ug/dL) RP	RER	344-345
Serum sum retinyl esters: SI (umol/L) RP	RERSI	346-349
Serum cholesterol (mg/dL) RP	TCR	350-352
Serum cholesterol: SI (mmol/L) RP	TCRSI	353-357

NHANES III Laboratory Data File Index
Whole Blood, Serum, Plasma, and Urine Data

Description	Variable Name	Positions
Serum triglycerides (mg/dL) RP	TGR	358-361
Serum triglycerides: SI (mmol/L) RP	TGRSI	362-366
Serum LDL cholesterol (mg/dL) RP	LCR	367-369
Serum LDL cholesterol: SI (mmol/L) RP	LCRSI	370-373
Serum HDL cholesterol (mg/dL) RP	HDR	374-376
Serum HDL cholesterol: SI (mmol/L) RP	HDRSI	377-380
Serum apolipoprotein AI (mg/dL) RP	AAR	381-383
Serum apolipoprotein AI: SI (g/L) RP	AARSI	384-387
Serum apolipoprotein B (mg/dL) RP	ABR	388-390
Serum apolipoprotein B: SI (g/L) RP	ABRSI	391-394
Serum lipoprotein (a) (mg/dL) RP	LPR	395-397
Serum lipoprotein (a): SI (g/L) RP	LPRSI	398-401
Follicle stim hormone: SI (IU/L) RP	FHRSI	402-406
Serum luteinizing hormone: SI (IU/L) RP	LHRSI	407-410
Plasma fibrinogen (mg/dL) RP	FBR	411-414
Plasma fibrinogen: SI (g/L) RP	FBRSI	415-418
Serum C-reactive protein (mg/dL) RP	CRR	419-422
SECOND EXAM DATA		
ANTIBODY TESTS		
Serum tetanus antibody (U/mL) RP	TER	423-427
Serum hepatitis A antibody (anti-HAV) RP	AHR	428
Serum hepatitis B core antibody RP	HBR	429
Serum hepatitis B surface antibody RP	SSR	430-431
Serum hepatitis B surface antigen RP	SAR	432
Serum hepatitis C antibody (anti-HCV) RP	HCR	433
Serum hepatitis D antibody (anti-HDV) RP	DHR	434
Serum herpes I antibody RP	H1R	435
Serum herpes II antibody RP	H2R	436
Serum rubella antibody RP	RUR	437-441
Serum rubella antibody (IU)	RURUNIT	442-444
Serum varicella antibody RP	VRR	445-449
Serum toxoplasmosis antibody RP	TOR	450-452
Serum rheumatoid factor RP	RFR	453-456
SECOND EXAM DATA		
BIOCHEMISTRY PROFILE		
Serum sodium: SI (mmol/L) RP	NARSI	457-461

NHANES III Laboratory Data File Index
Whole Blood, Serum, Plasma, and Urine Data

Description	Variable Name	Positions
Serum potassium: SI (mmol/L) RP	SKRSI	462-465
Serum chloride: SI (mmol/L) RP	CLRSI	466-470
Serum bicarbonate: SI (mmol/L) RP	C3RSI	471-472
Serum total calcium (mg/dL) RP	SCR	473-476
Serum total calcium: SI (mmol/L) RP	SCRSI	477-481
Serum phosphorus (mg/dL) RP	PSR	482-484
Serum phosphorus: SI (mmol/L) RP	PSRSI	485-489
Serum uric acid (mg/dL) RP	UAR	490-493
Serum uric acid: SI (umol/L) RP	UARSI	494-498
Serum glucose (mg/dL) RP	SGR	499-501
Serum glucose: SI (mmol/L) RP	SGRSI	502-506
Serum blood urea nitrogen (mg/dL) RP	BUR	507-508
Blood urea nitrogen: SI (mmol/L) RP	BURSI	509-513
Serum total bilirubin (mg/dL) RP	TBR	514-516
Serum total bilirubin: SI (umol/L) RP	TBRSI	517-521
Serum creatinine (mg/dL) RP	CER	522-525
Serum creatinine: SI (umol/L) RP	CERSI	526-530
Serum iron (ug/dL) RP	SFR	531-533
Serum iron: SI (umol/L) RP	SFRSI	534-537
Serum cholesterol (mg/dL) RP	CHR	538-540
Serum cholesterol: SI (mmol/L) RP	CHRSI	541-546
Serum triglycerides (mg/dL) RP	TRR	547-550
Serum triglycerides: SI (mmol/L) RP	TRRSI	551-556
Aspartate aminotransferase: SI (U/L) RP	ASRSI	557-559
Alanine aminotransferase: SI (U/L) RP	ATRSI	560-562
Gamma glutamyl transferase: SI (U/L) RP	GGRSI	563-565
Serum lactate dehydrogenase: SI (U/L) RP	LDRSI	566-568
Serum alkaline phosphatase: SI (U/L) RP	APRSI	569-571
Serum total protein (g/dL) RP	TPR	572-574
Serum total protein: SI (g/L) RP	TPRSI	575-576
Serum albumin (g/dL) RP	AMR	577-579
Serum albumin: SI (g/L) RP	AMRSI	580-581
Serum globulin (g/dL) RP	GBR	582-584
Serum globulin: SI (g/L) RP	GBRSI	585-586
Serum osmolality: SI (mmol/Kg) RP	OSRSI	587-589

SECOND EXAM DATA

DIABETES TESTING PROFILE

Glycated hemoglobin: (%) RP	GHR	590-593

NHANES III Laboratory Data File Index
Whole Blood, Serum, Plasma, and Urine Data

Description	Variable Name	Positions
Glycated hemoglobin: test method RP	GHRMETH	594
Plasma glucose (mg/dL) RP	G1R	595-599
Plasma glucose: SI (mmol/L) RP	G1RSI	600-605
Incomplete glucose test (OGTT) code RP	G1RCODE	606-607
Plasma second glucose (mg/dL) RP	G2R	608-612
Plasma second glucose: SI (mmol/L) RP	G2RSI	613-618
Serum C-peptide (pmol/mL) RP	C1R	619-623
Serum C-peptide: SI (nmol/L) RP	C1RSI	624-628
Second serum C-peptide (pmol/mL) RP	C2R	629-633
Second serum C-peptide: SI (nmol/L) RP	C2RSI	634-638
Serum insulin (uU/mL) RP	I1R	639-644
Serum insulin: SI (pmol/L) RP	I1RSI	645-651
Serum insulin: test kit RP	I1R2PFLG	652
Second serum insulin (uU/mL) RP	I2R	653-658
Second serum insulin: SI (pmol/L) RP	I2RSI	659-665
SECOND EXAM DATA		
URINE TESTS		
Urinary cadmium (ng/mL) RP	UDR	666-669
Urinary cadmium: SI (nmol/L) RP	UDRSI	670-674
Urinary creatinine (mg/dL) RP	URR	675-679
Urinary creatinine (mg/dL) - SS	URRSI	680-683
Urinary albumin (ug/mL)-RP	UBR	684-688
Urinary iodine (ug/dL) RP	UIR	689-693

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

DATASET=LABSE
N=2596 DOCUMENTATION DATE=06/22/99

GENERAL INFORMATION

Positions SAS name	Counts	Item description and code	Notes
1-5		Sample person identification number	
SEQN	2596	00009-53616	
6		Examination session for MEC	
MXRSESSR		examinees - replicates	
	1417	1 Morning	
	686	2 Afternoon	
	493	3 Evening	
7-8		Month of second exam	
MXRTIMO	148	01	
	116	02	
	169	03	
	160	04	
	183	05	
	117	06	
	118	07	
	200	08	
	130	09	
	152	10	
	146	11	
	88	12	
	869	Blank	
9-10		Number of days between exams	
MXPRDAYS	1	00 None/never	
	1726	01-52	
	869	Blank	

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Whole Blood, Serum, Plasma, and Urine Data

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

PHLEBOTOMY SCREENING QUESTIONNAIRE

Positions SAS name	Counts		Item description and code	Notes
11			Language RP	See note
PHRLANG	1564	1	English	
	106	2	Spanish	
	926	8	Blank but applicable	
12			Do you have hemophilia? This is a hereditary blood-clotting disorder RP	See note
PHRHEMO	1670	2	No	
	926	8	Blank but applicable	
13			Within the past four weeks have you received any cancer chemotherapy treatment? RP	See note
PHRCHM2	1	1	Yes, subsequent fields blank	
	1669	2	No	
	926	8	Blank but applicable	
14			Are you currently taking insulin? RP	See note
PHRINSU	31	1	Yes	
	1638	2	No	
	926	8	Blank but applicable	
	1		Blank	
15-19			Including your last meal and any snacks, at what time did you last have anything at all to eat? RP	
PHRSNTI	1669		00:00-23:30	
	926		88888 Blank but applicable	
	1		Blank	
20			Day participant last ate RP	
PHRSNDA	960	1	Yesterday	
	708	2	Today	
	927	8	Blank but applicable	
	1		Blank	

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

PHLEBOTOMY SCREENING QUESTIONNAIRE

Positions SAS name	Counts	Item description and code	Notes
21 PHRDRIN		Have you had anything to drink, other than water, after the time you last ate? RP	
	173	1 Yes	
	1496	2 No, subsequent drink fields blank	
	926	8 Blank but applicable	
	1	Blank	
22-26 PHRDRTI		At what time did you last have anything at all to drink other than water? RP	
	173	00:00-23:45	
	926	88888 Blank but applicable	
	1497	Blank	
27 PHRDRDA		Day participant last drank RP	
	67	1 Yesterday	
	106	2 Today	
	926	8 Blank but applicable	
	1497	Blank	
28-32 PHRFAST		Computed number of hours since last ate or drank RP	See note
	1668	00.03-40.73	
	927	88888 Blank but applicable	
	1	Blank	
33-37 PHRBEST		Time of venipuncture RP	See note
	1669	08:14-21:37	
	926	88888 Blank but applicable	
	1	Blank	

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code	Notes
38-42		White blood cell count RP	See note
WCR	2358	002.5-032.5	
	230	88888 Blank but applicable	
	8	Blank	
43-47		White blood cell count: SI RP	
WCRSI	2358	002.5-032.5	
	230	88888 Blank but applicable	
	8	Blank	
48-52		Lymphocyte percent (Coulter) RP	
LMRPCNT	2359	04.85-082.4	
	229	88888 Blank but applicable	
	8	Blank	
53-57		Mononuclear percent (Coulter) RP	
MORPCNT	2343	00000-38.35	
	245	88888 Blank but applicable	
	8	Blank	
58-62		Granulocyte percent (Coulter) RP	
GRRPCNT	2343	12.35-93.45	
	245	88888 Blank but applicable	
	8	Blank	
63-66		Lymphocyte number (Coulter) RP	See note
LMR	2358	0.55-25.9	
	230	8888 Blank but applicable	
	8	Blank	
67-70		Mononuclear number (Coulter) RP	See note
MOR	2342	0000-3.46	
	246	8888 Blank but applicable	
	8	Blank	
71-75		Granulocyte number (Coulter) RP	See note
GRR	2342	000.2-13.05	
	246	88888 Blank but applicable	
	8	Blank	

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code	Notes
76-79		Red blood cell count RP	See note
RCR	2357	2.69-6.56	
	231	8888 Blank but applicable	
	8	Blank	
80-83		Red blood cell count: SI RP	
RCRSI	2357	2.69-6.56	
	231	8888 Blank but applicable	
	8	Blank	
84-88		Hemoglobin (g/dL) RP	See note
HGR	2358	00007-018.8	
	230	88888 Blank but applicable	
	8	Blank	
89-93		Hemoglobin: SI (g/L) RP	
HGRSI	2358	00070-00188	
	230	88888 Blank but applicable	
	8	Blank	
94-98		Hematocrit (%) RP	See note
HTR	2357	023.2-055.9	
	231	88888 Blank but applicable	
	8	Blank	
99-103		Hematocrit: SI (L/L=1) RP	
HTRSI	2357	0.232-0.559	
	231	88888 Blank but applicable	
	8	Blank	
104-108		Mean cell volume: SI (fL) RP	See note
MVRSI	2358	057.6-106.7	
	230	88888 Blank but applicable	
	8	Blank	
109-113		Mean cell hemoglobin: SI (pg) RP	See note
MCRSI	2358	016.8-36.65	
	230	88888 Blank but applicable	
	8	Blank	

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code	Notes
114-118 MHR		Mean cell hemoglobin concentration (g/dL) RP	See note
	2358	28.35-037.1	
	230	88888 Blank but applicable	
	8	Blank	
119-123 MHRSI		M cell hemoglobin concentration: SI (g/L) RP	
	2358	283.5-00371	
	230	88888 Blank but applicable	
	8	Blank	
124-128 RWR		Red cell distribution width (%) RP	
	2358	011.1-023.4	
	230	88888 Blank but applicable	
	8	Blank	
129-134 RWRSI		Red cell distribution width: SI (fraction) RP	
	2358	00.111-00.234	
	230	888888 Blank but applicable	
	8	Blank	
135-139 PLR		Platelet count RP	See note
	2325	00021-00886	
	263	88888 Blank but applicable	
	8	Blank	
140-144 PLRSI		Platelet count: SI RP	
	2325	00021-00886	
	263	88888 Blank but applicable	
	8	Blank	
145-149 DWR		Platelet distribution width (%) RP	
	2356	00008-20.15	
	232	88888 Blank but applicable	
	8	Blank	

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code	Notes
150-154		Mean platelet volume: SI (fL) RP	
PVRSI	2358	004.8-018.2	
	230	88888 Blank but applicable	
	8	Blank	
155-157		Segmented neutrophils (percent of 100 cells) RP	See note
GRRDIF	720	014-085	
	27	888 Blank but applicable	
	1849	Blank	
158-160		Lymphocytes (percent of 100 cells) RP	See note
LMRDIF	720	007-084	
	27	888 Blank but applicable	
	1849	Blank	
161-162		Monocytes (percent of 100 cells) RP	See note
MORDIF	720	00-26	
	27	88 Blank but applicable	
	1849	Blank	
163-164		Eosinophils (percent of 100 cells) RP	See note
EOR	720	00-21	
	27	88 Blank but applicable	
	1849	Blank	
165		Basophils (percent of 100 cells) RP	See note
BOR	720	0-4	
	27	8 Blank but applicable	
	1849	Blank	
166		Blasts (percent of 100 cells) RP	See note
BLR	720	0	
	27	8 Blank but applicable	
	1849	Blank	
167		Promyelocytes (percent of 100 cells) RP	See note
PRR	720	0	
	27	8 Blank but applicable	
	1849	Blank	

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code	Notes
168		Metamyelocytes (percent of 100 cells) RP	See note
MER	720	0-2	
	27	8 Blank but applicable	
	1849	Blank	
169		Myelocytes (percent of 100 cells) RP	See note
MLR	720	0-1	
	27	8 Blank but applicable	
	1849	Blank	
170-171		Bands (percent of 100 cells) RP	See note
BAR	720	00-18	
	27	88 Blank but applicable	
	1849	Blank	
172-173		Atypical lymphocytes (percent of 100 cells) RP	See note
LAR	720	00-10	
	27	88 Blank but applicable	
	1849	Blank	
174		Anisocytosis (variation of cell size) RP	See note
ANR	555	0 Normal	
	165	1-4 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
175		Basophilic stippling RP	See note
BSR	714	0 Normal	
	6	1-2 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
176		Hypochromia (stain intensity of cell) RP	See note
HZR	634	0 Normal	
	86	1-4 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	

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SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code	Notes
177		Poikilocytosis (cell shape variation) RP	See note
PKR	638	0 Normal	
	82	1-3 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
178		Polychromatophilia (bluish color of cell) RP	See note
POR	625	0 Normal	
	95	1-2 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
179		Macrocytosis (large cell prevalence) RP	See note
MRR	657	0 Normal	
	63	1-2 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
180		Microcytosis (small cell prevalence) RP	See note
MIR	624	0 Normal	
	96	1-3 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
181		Sickle cells RP	See note
SIR	718	0 Normal	
	2	1-2 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	
182		Spherocytosis RP	See note
SHR	667	0 Normal	
	53	1-3 Gradation to abnormal	
	27	8 Blank but applicable	
	1849	Blank	

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

HEMATOLOGY

Positions SAS name	Counts	Item description and code		Notes
183		Target cells RP		See note
TTR	667	0	Normal	
	53	1-3	Gradation to abnormal	
	27	8	Blank but applicable	
	1849	Blank		
184		Toxic granulation RP		See note
TXR	694	0	Normal	
	26	1-4	Gradation to abnormal	
	27	8	Blank but applicable	
	1849	Blank		
185		Vacuolated cells RP		See note
VUR	720	0	Normal	
	27	8	Blank but applicable	
	1849	Blank		

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
186-189		Lead (ug/dL) RP	
PBR	187	00.7 Below level of detection	
	2195	0001-36.3	
	206	8888 Blank but applicable	
	8	Blank	
190-194		Lead: SI (umol/L) RP	
PBRSI	187	0.034 Below level of detection	
	2195	0.048-1.752	
	206	88888 Blank but applicable	
	8	Blank	
195-198		Protoporphyrin (ug/dL RBC) RP	
EPR	2381	0020-0699	
	207	8888 Blank but applicable	
	8	Blank	
199-203		Protoporphyrin: SI (umol/L RBC) RP	
EPRSI	2381	00.36-12.44	
	207	88888 Blank but applicable	
	8	Blank	
204-206		Serum iron (ug/dL) RP	See note
FER	2371	006-312	
	217	888 Blank but applicable	
	8	Blank	
207-211		Serum iron: SI (umol/L) RP	
FERSI	2371	01.07-55.88	
	217	88888 Blank but applicable	
	8	Blank	
212-215		Serum TIBC (ug/dL) RP	
TIR	2291	0192-0623	
	297	8888 Blank but applicable	
	8	Blank	
216-221		Serum TIBC: SI (umol/L) RP	
TIRSI	2291	034.39-111.58	
	297	888888 Blank but applicable	
	8	Blank	

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
222-225		Transferrin saturation (%) RP	See note
PXR	2290	01.3-94.5	
	298	8888 Blank but applicable	
	8	Blank	
226-229		Serum ferritin (ng/mL) RP	
FRR	3	0002 Below level of detection	
	2361	0003-2333	
	224	8888 Blank but applicable	
	8	Blank	
230-233		Serum ferritin: SI (ug/L) RP	
FRRSI	3	0002 Below level of detection	
	2361	0003-2333	
	224	8888 Blank but applicable	
	8	Blank	
234-237		Serum folate (ng/mL) RP	See note
FOR	2360	00.8-0070	
	227	8888 Blank but applicable	
	9	Blank	
238-242		Serum folate: SI (nmol/L) RP	
FORSI	2360	001.8-158.6	
	227	88888 Blank but applicable	
	9	Blank	
243-246		RBC folate (ng/mL) RP	See note
RBR	1657	0029-1303	
	930	8888 Blank but applicable	
	9	Blank	
247-252		RBC folate: SI (nmol/L) RP	
RBRSI	1657	0065.7-2952.6	
	930	888888 Blank but applicable	
	9	Blank	
253-257		Serum vitamin B12 (pg/mL) RP	
VBR	1158	00062-38300	
	235	88888 Blank but applicable	
	1203	Blank	

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SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Positions / SAS name	Counts	Item description and code	Notes
258-265		Serum vitamin B12: SI (pmol/L)	
VBRSI		RP	
	1158	00045.74-28257.74	
	235	88888888 Blank but applicable	
	1203	Blank	
266-269		Serum vitamin C (mg/dL) RP	See note
VCR	1594	0000-4.23	
	253	8888 Blank but applicable	
	749	Blank	
270-275		Serum vitamin C: SI (mmol/L) RP	
VCRSI	1594	000000-240.18	
	253	888888 Blank but applicable	
	749	Blank	
276-279		Serum normalized calcium: SI (mmol/L)	See note
ICRSI		RP	
	1314	1.06-1.62	
	338	8888 Blank but applicable	
	944	Blank	
280-283		Serum total calcium: SI (mmol/L) RP	
CARSI	1462	1.67-2.77	
	190	8888 Blank but applicable	
	944	Blank	
284-286		Serum selenium (ng/mL) RP	See note
SER	2102	070-293	
	281	888 Blank but applicable	
	213	Blank	
287-290		Serum selenium: SI (nmol/L) RP	
SERSI	2102	0.89-3.72	
	281	8888 Blank but applicable	
	213	Blank	
291-293		Vitamin A (ug/dL) RP	
VAR	2333	005-185	
	254	888 Blank but applicable	
	9	Blank	

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SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
294-297		Serum vitamin A: SI (umol/L) RP	
VARSI	2333	0.17-6.46	
	254	8888 Blank but applicable	
	9	Blank	
298-302		Serum vitamin E (ug/dL) RP	See note
VER	2333	00162-09999	
	254	88888 Blank but applicable	
	9	Blank	
303-308		Serum vitamin E: SI (umol/L) RP	
VERSI	2333	003.76-232.18	
	254	888888 Blank but applicable	
	9	Blank	
309-311		Serum alpha carotene (ug/dL) RP	
ACR	2333	000-087	
	254	888 Blank but applicable	
	9	Blank	
312-315		Serum alpha carotene: SI (umol/L) RP	
ACRSI	2333	0000-1.62	
	254	8888 Blank but applicable	
	9	Blank	
316-318		Serum beta carotene (ug/dL) RP	See note
BCR	2333	001-407	
	254	888 Blank but applicable	
	9	Blank	
319-322		Serum beta carotene: SI (umol/L) RP	
BCRSI	2333	0.02-7.58	
	254	8888 Blank but applicable	
	9	Blank	
323-325		Serum beta cryptoxanthin (ug/dL) RP	
BXR	2333	000-088	
	254	888 Blank but applicable	
	9	Blank	

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
326-329 BXRSI		Serum beta cryptoxanthin: SI (umol/L) RP	
	2333	0000-1.59	
	254	8888 Blank but applicable	
	9	Blank	
330-332 LUR		Serum lutein/zeaxanthin (ug/dL) RP	See note
	2333	003-143	
	254	888 Blank but applicable	
	9	Blank	
333-336 LURSI		Serum lutein/zeaxanthin: SI (umol/L) RP	
	2333	0.05-2.51	
	254	8888 Blank but applicable	
	9	Blank	
337-339 LYR		Lycopene (ug/dL) RP	See note
	1	000 Below level of detection	
	2332	001-098	
	254	888 Blank but applicable	
	9	Blank	
340-343 LYRSI		Serum lycopene: SI (umol/L) RP	
	1	0.00 Below level of detection	
	2332	0.02-1.83	
	254	8888 Blank but applicable	
	9	Blank	
344-345 RER		Serum sum retinyl esters (ug/dL) RP	
	2332	00-46	
	255	88 Blank but applicable	
	9	Blank	
346-349 RERSI		Serum sum retinyl esters: SI (umol/L) RP	
	2332	0000-1.61	
	255	8888 Blank but applicable	
	9	Blank	

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GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
350-352		Serum cholesterol (mg/dL) RP	
TCR	2362	072-402	
	226	888 Blank but applicable	
	8	Blank	
353-357		Serum cholesterol: SI (mmol/L) RP	
TCRSI	2362	01.86-010.4	
	226	88888 Blank but applicable	
	8	Blank	
358-361		Serum triglycerides (mg/dL) RP	See note
TGR	2355	0014-2099	
	233	8888 Blank but applicable	
	8	Blank	
362-366		Serum triglycerides: SI (mmol/L) RP	
TGRSI	2355	00.16-023.7	
	233	88888 Blank but applicable	
	8	Blank	
367-369		Serum LDL cholesterol (mg/dL) RP	See note
LCR	745	040-281	
	252	888 Blank but applicable	
	1599	Blank	
370-373		Serum LDL cholesterol: SI (mmol/L) RP	
LCRSI	745	1.03-7.27	
	252	8888 Blank but applicable	
	1599	Blank	
374-376		Serum HDL cholesterol (mg/dL) RP	
HDR	2339	011-153	
	249	888 Blank but applicable	
	8	Blank	
377-380		Serum HDL cholesterol: SI (mmol/L) RP	
HDRSI	2339	0.28-3.96	
	249	8888 Blank but applicable	
	8	Blank	

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SECOND EXAM DATA

GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
381-383		Serum apolipoprotein AI (mg/dL) RP	See note
AAR	1110	082-250	
	84	888 Blank but applicable	
	1402	Blank	
384-387		Serum apolipoprotein AI: SI (g/L) RP	
AARSI	1110	0.82-02.5	
	84	8888 Blank but applicable	
	1402	Blank	
388-390		Serum apolipoprotein B (mg/dL) RP	See note
ABR	1113	043-220	
	81	888 Blank but applicable	
	1402	Blank	
391-394		Serum apolipoprotein B: SI (g/L) RP	
ABRSI	1113	0.43-02.2	
	81	8888 Blank but applicable	
	1402	Blank	
395-397		Serum lipoprotein (a) (mg/dL) RP	
LPR	1247	000-249	
	1	888 Blank but applicable	
	1348	Blank	
398-401		Serum lipoprotein (a): SI (g/L) RP	
LPRSI	1247	0000-2.49	
	1	8888 Blank but applicable	
	1348	Blank	
402-406		Serum follicle stimulating hormone: SI	
FHRSI		(IU/L) RP	
	1	000.1 Below level of detection	
	285	000.8-128.3	
	2310	Blank	
407-410		Serum luteinizing hormone: SI (IU/L)	
LHRSI		RP	
	286	00.3-0044	
	2310	Blank	

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GENERAL BIOCHEMISTRY TESTS

Positions SAS name	Counts	Item description and code	Notes
411-414		Plasma fibrinogen (mg/dL) RP	
FBR	1217	0022-0755	
	6	8888 Blank but applicable	
	1373	Blank	
415-418		Plasma fibrinogen: SI (g/L) RP	
FBRSI	1217	0.22-7.55	
	6	8888 Blank but applicable	
	1373	Blank	
419-422		Serum C-reactive protein (mg/dL)	
CRR		RP	
	1541	0.21 Below level of detection	
	791	00.3-10.3	
	105	8888 Blank but applicable	
	159	Blank	

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SECOND EXAM DATA

ANTIBODY TESTS

Positions SAS name	Counts	Item description and code	Notes
423-427		Serum tetanus antibody (U/mL) RP	
TER	1454	00000-37.33	
	402	88888 Blank but applicable	
	740	Blank	
428		Serum hepatitis A antibody	
AHR		(anti-HAV) RP	
	700	1 Positive	
	854	2 Negative	
	1	3 Borderline	
	59	8 Blank but applicable	
	982	Blank	
429		Serum hepatitis B core antibody	See note
HBR		(anti-HBc) RP	
	113	1 Positive	
	1441	2 Negative	
	1	3 Borderline	
	59	8 Blank but applicable	
	982	Blank	
430-431		Serum hepatitis B surface antibody	See note
SSR		(anti-HBs) RP	
	55	01 Positive	
	12	02 Negative	
	5	03 Borderline	
	27	11 > 10 mIU	
	7	22 < 10 mIU	
	13	88 Blank but applicable	
	2477	Blank	
432		Serum hepatitis B surface antigen	See note
SAR		(HBsAg) RP	
	4	1 Positive	
	108	2 Negative	
	1	3 Borderline	
	6	8 Blank but applicable	
	2477	Blank	

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Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

ANTIBODY TESTS

Positions SAS name	Counts	Item description and code	Notes
433		Serum hepatitis C antibody	
HCR		(anti-HCV) RP	
	38	1 Positive	
	1513	2 Negative	
	1	4 Indeterminate	
	62	8 Blank but applicable	
	982	Blank	
434		Serum hepatitis D antibody	See note
DHR		(anti-HDV) RP	
	4	2 Negative	
	1	8 Blank but applicable	
	2591	Blank	
435		Serum herpes I antibody RP	
H1R	726	1 Positive	
	208	2 Negative	
	2	3 Indeterminate	
	88	8 Blank but applicable	
	1572	Blank	
436		Serum herpes II antibody RP	
H2R	265	1 Positive	
	662	2 Negative	
	9	3 Indeterminate	
	88	8 Blank but applicable	
	1572	Blank	
437-441		Serum rubella antibody RP	See note
RUR	1575	00000-18.68	
	48	88888 Blank but applicable	
	973	Blank	
442-444		Serum rubella antibody (IU)	See note
RURUNIT	1575	000-544	
	48	888 Blank but applicable	
	973	Blank	

NHANES III Laboratory Data File
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SECOND EXAM DATA

ANTIBODY TESTS

Positions SAS name	Counts	Item description and code	Notes
445-449		Serum varicella antibody RP	See note
VRR	1575	00000-25.43	
	48	88888 Blank but applicable	
	973	Blank	
450-452		Serum toxoplasmosis antibody RP	See note
TOR	1705	000-240	
	124	888 Blank but applicable	
	767	Blank	
453-456		Serum rheumatoid factor RP	
RFR	699	0000-2560	
	35	8888 Blank but applicable	
	1862	Blank	

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SECOND EXAM DATA

BIOCHEMISTRY PROFILE

Positions SAS name	Counts	Item description and code	Notes
457-461		Serum sodium: SI (mmol/L) RP	
NARSI	2150	122.8-150.3	
	446	Blank	
462-465		Serum potassium: SI (mmol/L) RP	
SKRSI	2150	2.53-6.58	
	446	Blank	
466-470		Serum chloride: SI (mmol/L) RP	
CLRSI	2150	00087-114.6	
	446	Blank	
471-472		Serum bicarbonate: SI (mmol/L) RP	
C3RSI	2150	16-44	
	446	Blank	
473-476		Serum total calcium (mg/dL) RP	
SCR	2150	07.7-15.7	
	446	Blank	
477-481		Serum total calcium: SI (mmol/L) RP	
SCRSI	2150	1.925-3.925	
	446	Blank	
482-484		Serum phosphorus (mg/dL) RP	
PSR	2150	1.9-5.6	
	446	Blank	
485-489		Serum phosphorus: SI (mmol/L) RP	
PSRSI	2150	0.614-1.808	
	446	Blank	
490-493		Serum uric acid (mg/dL) RP	
UAR	2149	0001-12.2	
	447	Blank	
494-498		Serum uric acid: SI (umol/L) RP	
UARSI	2149	059.5-725.7	
	447	Blank	

NHANES III Laboratory Data File
Whole Blood, Serum, Plasma, and Urine Data

SECOND EXAM DATA

BIOCHEMISTRY PROFILE

Positions SAS name	Counts	Item description and code	Notes
499-501		Serum glucose (mg/dL) RP	See note
SGR	2150	038-509	
	446	Blank	
502-506		Serum glucose: SI (mmol/L) RP	
SGRSI	2150	02.11-28.25	
	446	Blank	
507-508		Serum blood urea nitrogen (mg/dL) RP	
BUR	2150	03-97	
	446	Blank	
509-513		Serum blood urea nitrogen: SI (mmol/L)	
BURSI		RP	
	2150	01.07-34.63	
	446	Blank	
514-516		Serum total bilirubin (mg/dL) RP	
TBR	2150	000-3.9	
	446	Blank	
517-521		Serum total bilirubin: SI (umol/L) RP	
TBRSI	2150	00000-066.7	
	446	Blank	
522-525		Serum creatinine (mg/dL) RP	
CER	2150	00.5-11.2	
	446	Blank	
526-530		Serum creatinine: SI (umol/L) RP	
CERSI	2150	044.2-990.1	
	446	Blank	
531-533		Serum iron (ug/dL) RP	See note
SFR	1652	003-293	
	944	Blank	
534-537		Serum iron: SI (umol/L) RP	
SFRSI	1652	00.5-52.5	
	944	Blank	

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SECOND EXAM DATA

BIOCHEMISTRY PROFILE

Positions SAS name	Counts	Item description and code	Notes
538-540		Serum cholesterol (mg/dL) RP	See note
CHR	2150	070-415	
	446	Blank	
541-546		Serum cholesterol: SI (mmol/L) RP	
CHRSI	2150	001.81-10.732	
	446	Blank	
547-550		Serum triglycerides (mg/dL) RP	See note
TRR	1652	0020-2050	
	944	Blank	
551-556		Serum triglycerides: SI (mmol/L) RP	
TRRSI	1652	00.226-23.144	
	944	Blank	
557-559		Serum aspartate aminotransferase: SI	
ASRSI		(U/L) RP	
	2150	007-695	
	446	Blank	
560-562		Serum alanine aminotransferase: SI	
ATRSI		(U/L) RP	
	2150	002-394	
	446	Blank	
563-565		Serum gamma glutamyl transferase: SI	See note
GGRSI		(U/L) RP	
	1706	004-790	
	890	Blank	
566-568		Serum lactate dehydrogenase: SI	
LDRSI		(U/L) RP	
	2150	048-496	
	446	Blank	
569-571		Serum alkaline phosphatase: SI	
APRSI		(U/L) RP	
	2150	018-620	
	446	Blank	

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SECOND EXAM DATA

BIOCHEMISTRY PROFILE

Positions SAS name	Counts	Item description and code	Notes
572-574		Serum total protein (g/dL) RP	
TPR	2150	5.9-9.4	
	446	Blank	
575-576		Serum total protein: SI (g/L) RP	
TPRSI	2150	59-94	
	446	Blank	
577-579		Serum albumin (g/dL) RP	
AMR	2150	2.5-5.3	
	446	Blank	
580-581		Serum albumin: SI (g/L) RP	
AMRSI	2150	25-53	
	446	Blank	
582-584		Serum globulin (g/dL) RP	See note
GBR	1652	1.9-006	
	944	Blank	
585-586		Serum globulin: SI (g/L) RP	
GBRSI	1652	19-60	
	944	Blank	
587-589		Serum osmolality: SI (mmol/Kg) RP	See note
OSRSI	1652	262-309	
	944	Blank	

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SECOND EXAM DATA

DIABETES TESTING PROFILE

Positions SAS name	Counts	Item description and code	Notes
590-593		Glycated hemoglobin: (%) RP	See note
GHR	2294	03.4-0014	
	150	8888 Blank but applicable	
	152	Blank	
594		Glycated hemoglobin: test method RP	See note
GHRMETH	1370	1 Diamat method (instrument 1)	
	506	2 Diamat method (instrument 2)	
	244	3 Diamat method (instrument 3)	
	174	4 Affinity method	
	150	8 Blank but applicable	
	152	Blank	
595-599		Plasma glucose - first venipuncture	See note
G1R		(mg/dL) RP	
	1259	052.7-444.1	
	384	88888 Blank but applicable	
	953	Blank	
600-605		Plasma glucose - first venipuncture: SI	
G1RSI		(mmol/L) RP	
	1259	02.925-24.652	
	384	888888 Blank but applicable	
	953	Blank	
606-607		Incomplete glucose test (OGTT) code RP	See note
G1RCODE	28	22 Diabetic on insulin	
	3	23 Refused venipuncture	
	8	25 Venipuncture unsuccessful	
	2	26 Physician canceled test	
	18	27 Refused glucose challenge	
	181	99 All remaining reasons	
	2356	Blank	
608-612		Plasma glucose - second venipuncture	See note
G2R		(mg/dL) RP	
	636	030.3-573.4	
	208	88888 Blank but applicable	
	1752	Blank	

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SECOND EXAM DATA

DIABETES TESTING PROFILE

Positions SAS name	Counts	Item description and code	Notes
613-618 G2RSI		Plasma glucose - second venipuncture: SI (mmol/L) RP	
	636	01.682-31.829	
	208	888888 Blank but applicable	
	1752	Blank	
619-623 C1R		Serum C-peptide - first venipuncture (pmol/mL) RP	See note
	3	0.021 Below level of detection	
	1254	00.03-4.602	
	382	88888 Blank but applicable	
	957	Blank	
624-628 C1RSI		Serum C-peptide - first venipuncture: SI (nmol/L) RP	
	3	0.021 Below level of detection	
	1254	00.03-4.602	
	382	88888 Blank but applicable	
	957	Blank	
629-633 C2R		Serum C-peptide - second venipuncture (pmol/mL) RP	See note
	1	0.021 Below level of detection	
	333	0.891-8.544	
	300	88888 Blank but applicable	
	1962	Blank	
634-638 C2RSI		Serum C-peptide - second venipuncture: SI (nmol/L) RP	
	1	0.021 Below level of detection	
	333	0.891-8.544	
	300	88888 Blank but applicable	
	1962	Blank	
639-644 I1R		Serum insulin - first venipuncture (uU/mL) RP	See note
	6	001.76 Below level of detection	
	1251	002.53-633.99	
	382	888888 Blank but applicable	
	957	Blank	

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DIABETES TESTING PROFILE

Positions SAS name	Counts	Item description and code	Notes
645-651 I1RSI		Serum insulin - first venipuncture: SI (pmol/L) RP	
	6	0010.56 Below level of detection	
	1251	0015.18-3803.94	
	382	8888888 Blank but applicable	
	957	Blank	
652 I1R2PFLG		Serum insulin - first venipuncture: test kit RP	See note
	220	1 Kit 1	
	143	2 Kit 2	
	894	3 Kit 3	
	382	8 Blank but applicable	
	957	Blank	
653-658 I2R		Serum insulin - second venipuncture (uU/mL) RP	See note
	333	008.07-0638.9	
	301	888888 Blank but applicable	
	1962	Blank	
659-665 I2RSI		Serum insulin - second venipuncture: SI (pmol/L) RP	
	333	0048.42-03833.4	
	301	8888888 Blank but applicable	
	1962	Blank	

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URINE TESTS

Positions SAS name	Counts	Item description and code	Notes
666-669		Urinary cadmium (ng/mL) RP	
UDR	1677	0.01-7.81	
	752	8888 Blank but applicable	
	167	Blank	
670-674		Urinary cadmium: SI (nmol/L) RP	
UDRSI	1677	00.09-69.49	
	752	88888 Blank but applicable	
	167	Blank	
675-679		Urinary creatinine (mg/dL) RP	See note
URR	10	007.9 Below level of detection	
	1634	011.3-554.3	
	1	88888 Blank but applicable	
	951	Blank	
680-683		Urinary creatinine: SI (mmol/L) RP	
URRSI	10	00.7 Below level of detection	
	1634	0001-0049	
	1	8888 Blank but applicable	
	951	Blank	
684-688		Urinary albumin (ug/mL) RP	
UBR	32	000.4 Below level of detection	
	1612	000.5-06200	
	1	88888 Blank but applicable	
	951	Blank	
689-693		Urinary iodine (ug/dL) RP	
UIR	1	000.1 Below level of detection	
	1557	000.6-13189	
	72	88888 Blank but applicable	
	966	Blank	

NOTES

AAR: Serum apolipoprotein AI

Apolipoprotein AI and apolipoprotein B results were measured only during 1988-1991. Three different methods were used at different times to measure apolipoprotein AI and apolipoprotein B. These were radial immunodiffusion (RID), rate immunonephelometry (INA), and the World Health Organization -International Federation of Clinical Chemistry (WHO-IFCC) method (Bachorik, 1994; Marcovina, 1991; Albers, 1989). Results using the RID and INA methods were adjusted to the WHO-IFCC method.

ABR: Serum apolipoprotein B

See note for AAR.

ANR: Anisocytosis

Microscopic examination (manual differential) of the peripheral blood spread on a glass slide utilized a stained blood film to perform a differential leukocyte count, evaluate red cell morphology, and estimate number of platelets. Manual differential variables include segmented neutrophils, lymphocytes, monocytes, eosinophils, basophils, blasts, promyelocytes, metamyelocytes, myelocytes, bands, atypical lymphocytes, anisocytosis, basophilic stippling, hypochromia, poikilocytosis, polychromatophilia, macrocytosis, microcytosis, sickle cells, spherocytosis, target cells, toxic granulation, and vacuolated cells (GRRDIF, LMRDIF, MORDIF, EOR, BAR, BOR, BLR, PRR, MER, MLR, BAR, LAR, ANR, BSR, HZR, PKR, POR, MRR, MIR, SIR, SHR, TTR, TXR, and VUR).

In NHANES III, a manual differential was performed on a special subsample of examinees aged one year and older. This manual differential was used for internal quality control purposes and to confirm abnormal hematology results. This subsample was defined as a random 10-percent sample of all examined persons plus all examinees who had a predetermined high or low value for one or more of the following hematologic assessments: white blood cell count (WBC), red blood cell count (RBC), hemoglobin, hematocrit, mean cell volume (MCV), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), red blood cell distribution width (RDW), platelet count, mean platelet volume (MPV), lymphocyte percentage, mononuclear percentage, or granulocyte percentage. A table of predetermined high and low values for WBC, RBC, hemoglobin, hematocrit, MCV, MCH, MCHC, RDW, platelet count, MPV, lymphocyte percentage, mononuclear percentage, and granulocyte percentage is located in the Manual for Medical Technicians (U.S. DHHS, pp. 5-54 and 5-55, 1996).

BAR: Band cells

See note for ANR.

BCR: Serum beta carotene

The lower limit of detection (LOD) for beta carotene was 0.67 ug/dL. Using the LOD coding formula (detection limit divided by the square root of two), the calculated value to indicate that the serum beta carotene results were below the level of detection would be 0.48. After rounding, the value of 0 (zero) was placed in the results field to indicate that the serum beta carotene was below 0.67 ug/dL.

BLR: Blast cells

See note for ANR.

BOR: Basophil cells

See note for ANR.

BSR: Basophilic stippling

See note for ANR.

C1R: Serum C-peptide (first venipuncture)

The specimen for this assay was obtained at the time of the initial venipuncture. This result is available for all six years of the survey.

Examinees aged 40-74 years who used insulin were excluded from the OGTT. A first venipuncture was obtained, but the glucose challenge and second venipuncture were canceled. In these instances, the variables G1R, C1R and I1R have a value, but the results G2R, C2R and I2R from the second venipuncture are blank-filled to indicate a medical exclusion.

C2R: Serum C-peptide (second venipuncture)

Post-glucose challenge levels of C-peptide and insulin for examinees who had an OGTT were measured only during 1991-1994.

CHR: Serum cholesterol

This value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result from the reference method (TCR), rather than the CHR value, is generally recommended. For most analyses of serum cholesterol, the appropriate variable to use will be TCR. The value from the biochemistry profile (CHR) should not be used routinely. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for the details.

DHR: Serum hepatitis D antibody

Hepatitis B virus testing scheme: From 1988-1991, all sera were tested for the core antibody to hepatitis B virus (anti-HBc). If this test was positive, the sera were tested for the hepatitis B surface antigen (HBsAg) and hepatitis B surface antibody (anti-HBs). If the HbsAg test was positive and the anti-HBs test was <10 mIU, then the antibody to hepatitis D virus (anti-HDV) test was performed. If the HbsAg test was negative and the anti-HBs test was <10 mIU, then the anti-HBc test was repeated for confirmation.

In June 1993, all sera were tested for both anti-HBc and anti-HBs. Sera testing positive for anti-HBc were tested further for HBsAg, and positive HBsAg samples were tested for anti-HDV.

EOR: Eosinophil cells

See note for ANR.

FER: Serum iron

Laboratory methods differed between NHANES III and previous surveys. Therefore, results may not be comparable between surveys. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996).

FOR: Serum folate

Laboratory methods differed between NHANES III and previous surveys. Therefore, results may not be comparable between surveys. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996).

G1R: Plasma glucose (first venipuncture)

Plasma glucose was measured using the reference method on examinees aged 20 years and older. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for details.

During NHANES III, OGTT testing was conducted on MEC examinees aged 40-74 years. A random assignment was made prior to conducting the OGGT to determine who should receive a morning examination (NCHS, 1994; U.S. DHHS, 1996). As a result, approximately half of the OGGT examinees received the morning OGTT after an overnight fast. This subsample most closely conformed to the World Health Organization (WHO) criteria for OGTT testing to identify diabetes (WHO, 1995). Therefore, this morning subsample is the NHANES III subsample that should be used to estimate the prevalence of diabetes and impaired glucose tolerance. People who reported a medical history of diabetes but who were not using insulin therapy were asked to conform to the fasting instructions for their examination session and were eligible for an OGTT if the age criteria were satisfied. The morning sample weights (WTPFHSD6) for total NHANES III weights for the morning OGTT subsample should be used when weighting these data to generate national estimates. Data from the

afternoon and evening OGTTs do not conform to the WHO protocol for diagnosing diabetes or IGT and should not be used for these purposes.

If an examinee was given an OGTT during an examination session other than the session assigned, that examinee's sample weight for the assigned session will be zero. For example, if an examinee was selected for a morning OGTT but was tested in the afternoon, the examinee's morning sample weight for the OGTT will be zero.

G1RCODE: Reasons for an incomplete glucose tolerance test

The reason for which an examinee aged 40-74 years did not complete the OGTT was entered in this field. This field either will contain an incomplete OGTT code or will be blank. Examinees who responded affirmatively to the hemophilia question (code 20) or who received chemotherapy within the past four weeks (code 21) were excluded from venipuncture. Examinees who reported on their examination day that they used insulin therapy (code 22) were excluded from the OGTT. Codes 23-27 were recoded from comments and notations on the questionnaires and may not include complete data on these reasons.

G2R: Plasma glucose (second venipuncture)

See notes for C1R and G1R.

GBR: Serum globulin

Globulin results were added to the protocol after NHANES III began. This result field was blank-filled for examinees who were examined prior to the start of testing.

GGRSI: Serum gamma glutamyl transferase

Gamma glutamyl transferase results were added to the protocol after NHANES III began. This result field was blank-filled for examinees who were examined prior to the start of testing.

GHR: Glycated hemoglobin (HbA1c)

Glycohemoglobin measurements for NHANES III were performed by the Diabetes Diagnostic Laboratory at the University of Missouri -- Columbia using the Diamat Analyzer System (Bio-Rad Laboratories, Hercules, CA). This ion-exchange HPLC system measures HbA1c (a specific glycohemoglobin) and has demonstrated excellent, long-term precision (interassay CV's 2.0). It was standardized to the reference method that was used for the Diabetes Control and Complications Trial (DCCT). Variant hemoglobins, including hemoglobin C, D, F, and elevated HbF, can interfere with HbA1c measurement by the Diamat HPLC. Hemoglobin S in its heterozygous state does not interfere with this assay. Although interferences usually can be detected by an abnormal Diamat chromatogram, HbA1c results for these specimens were not considered valid. Therefore, samples containing hemoglobin variants or elevated

HbF or samples that produce chromatograms indicating hemoglobin degradation were analyzed by an alternate method that used affinity chromatography to separate glycohemoglobin. Affinity chromatographic methods were not affected by the presence of hemoglobin variants and were less sensitive to hemoglobin degradation due to improper sample handling. The affinity method used also was standardized to the DCCT reference method. Reasons for using the affinity method for an examinee's test included an extra peak on the chromatogram, hemoglobin C, elevated hemoglobin F, or other abnormal hemoglobin.

GHRMETH: Glycated hemoglobin method

See note for GHR.

GRR: Granulocyte number

Consult the Manual for Medical Technicians for the Coulter granulocyte number, lymphocyte number, mononuclear number, white blood cell count, red blood cell count, and platelet count units (U.S. DHHS, 1996).

GRRDIF: Segmented neutrophil cells

See note for ANR.

HBR: Serum hepatitis B core antibody

See note for DHR.

HGR: Hemoglobin

In NHANES I, NHANES II, and HHANES, determinations of red and white blood cell counts were made using a semiautomated cell counter (Coulter model FN). Determinations of hemoglobin concentration (Hb) were made using a Coulter hemoglobinometer, and determinations of packed cell volume (PCV) were made using the microhematocrit centrifuge method. The hematologic indices MCH, MCHC, and MCV were calculated as follows:

$$MCH = Hb/RBC$$
$$MCHC = Hb/PCV$$
$$MCV = PCV/RBC$$

In NHANES III, these hematologic parameters were determined by using a fully automated Coulter S+JR hematology analyzer. These analyzers measured the mean (red) cell volume (MCV) directly, utilizing a process of continuous integration of pulse heights divided by the pulse number; PCV values were calculated through the multiplication of MCV and RBC.

Although it has been shown that identified errors in the microhematocrit method caused by plasma trapping and red cell dehydration approximately compensate each other (Bull, 1990), packing

errors can occur in macrocytic anemia and can be considerable in sickle cell anemia, spherocytosis, and thalassemias (NCCLS, 1993). Therefore, individual values for MCV, PCV ("hematocrit"), and MCHC from NHANES III cannot be compared directly to values from the previous NHANES.

HTR: Hematocrit

See note for HGR.

HZR: Hypochromia

See note for ANR.

I1R: Serum insulin (first venipuncture)

This is the adjusted insulin value for examinees. Most of the insulin values in NHANES III (1988-1991) were adjusted because the manufacturer of the laboratory testing kits changed during that period. An indicator of the kit number is located in the I1R2PFLG field (i.e., 1 = Kit 1, 2 = Kit 2, and 3 = Kit 3). All insulin values from Kit 1 and Kit 2 assays were adjusted linearly to match the Kit 3 numbers. Further information on this adjustment procedure is available in the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996).

The equations used to adjust the data were:

Kit 3 = 0.787 (Kit 1) + 0.832 Equation 1
Kit 3 = 0.597 (Kit 2) + 1.746 Equation 2

The following steps were used to make the adjustment:

1. Equation 1 was applied to group 1 (Kit 1) data
2. Equation 2 was applied to group 2 (Kit 2) data
3. Group 3 data (Kit 3) were left unchanged.

The time periods for the insulin kits were as follows:

Group	Assay Period	Assay Method
1	10/88-01/05/90	Kit 1
2	01/06/90-09/06/90	Kit 2
3	11/01/90-end of study	Kit 3

See note for C1R.

I1R2PFLG: Insulin adjustment flag

This field shows which kit was used for the original insulin measurement.

I2R: Serum insulin (second venipuncture)

See notes for C1R, C2R and I1R.

ICRSI: Serum normalized calcium

This variable contains the normalized calcium value derived from adjusting the measured ionized calcium for pH. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for details.

LAR: Atypical lymphocyte cells

See note for ANR.

LCR: Serum LDL cholesterol calculation

The value for LDL was calculated by the Friedewald equation as follows:

LDL = total cholesterol - high density cholesterol - triglyceride/5.

Because the equation is not valid when serum triglyceride values exceed 400 mg/dL, the LDL is missing when serum triglyceride (TGR) exceeds 400 mg/dL.

Serum LDL was calculated on examinees who were instructed to fast (ages 12 and older) and who did fast at least nine hours, were examined in the morning, and were randomly assigned to the morning fasting sample (WTPFHSD6 > 0). Therefore, LDL would be blank if examinees were aged less than 12 years, fasted fewer than nine hours, were examined in an afternoon or evening session, or were not randomly assigned to the morning session. For the purpose of this calculation, the number of hours fasted was rounded to the nearest whole integer.

For more information regarding this equation, refer to the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996).

LMR: Lymphocyte number

See note for GRR.

LMRDIF: Lymphocyte cells

See note for ANR.

LUR: Serum lutein/zeaxanthin

The lower limit of detection (LOD) for lutein/zeaxanthin was 0.43 ug/dL. Using the LOD coding formula (detection limit divided by the square root of two), the calculated value indicating that the serum lycopene results were below the level of detection would be 0.30. After rounding, the value of 0 (zero) was placed in the results field to

indicate that the serum lutein/zeaxanthin was below 0.43 ug/dL.

LYR: Serum lycopene

The lower limit of detection (LOD) for lycopene was 0.63 ug/dL. Using the LOD coding formula (detection limit divided by the square root of two), the calculated value indicating that the serum lycopene results were below the level of detection would be 0.44. After rounding, the value of 0 (zero) was placed in the results field to indicate that the serum lycopene was below 0.63 ug/dL.

MCRSI: Mean cell hemoglobin

See note for HGR.

MER: Metamyelocyte cells

See note for ANR.

MHR: Mean cell hemoglobin concentration

See note for HGR.

MIR: Microcytosis

See note for ANR.

MLR: Myelocyte cells

See note for ANR.

MOR: Mononuclear number

See note for GRR.

MORDIF: Monocyte cells

See note for ANR.

MRR: Macrocytosis

See note for ANR.

MVRSI: Mean cell volume

See note for HGR.

OSRSI: Serum osmolality

Results for osmolality were added to the protocol after NHANES III began. This result field is blank-filled for examinees who were examined prior to the start of testing.

PHRBEST: Time of venipuncture

The time of venipuncture is expressed using the 24-hour clock system (military time) in which 01:00 corresponds to 1:00 a.m., 12:00 corresponds to 12 noon, 13:00 corresponds to 1:00 p.m., and 00:00 corresponds to 12 midnight.

PHRCHM2: Within the past four weeks have you received any cancer chemotherapy treatment?

All examinees who indicated at the time of venipuncture that they had received cancer chemotherapy treatment in the past two weeks (later this was changed to four weeks) were excluded from venipuncture. For these examinees, results fields for blood-based analyses are blank-filled.

PHRFAST: Calculated fasting time in hours

The fasting time was calculated using the time of venipuncture and the time the examinee last ate or drank (other than water). This was determined using the snack/drink time and the corresponding day variables. Fasting time is the elapsed interval between the time the examinee last ate or drank and the time of venipuncture.

The following variables were used to calculate this variable: PHRSNTI, PHRSNDA, PHRDRIN, PHRDRTI, PHRDRDA, and PHRBEST. If the examinee drank only water since he/she last ate (PHRDRIN = 2), then the time and day the examinee last ate (PHRSNTI and PHRSNDA) were subtracted from the time and day of the venipuncture (PHRBEST). The difference was the number of hours between the time the examinee last ate and the time of the venipuncture.

If the examinee drank anything other than water (PHRDRIN = 1), then the time and day the examinee last drank (PHRDRTI and PHRDRDA) were subtracted from the time and day of the venipuncture (PHRBEST). The difference was the number of hours between the time the examinee last drank and the time of the venipuncture.

PHRHEMO: Do you have hemophilia?

All examinees who indicated at the time of venipuncture that they had hemophilia, a hereditary blood-clotting disorder, were excluded from the venipuncture. Results for blood analyses were blank-filled.

PHRINSU: Are you currently taking insulin?

See note for G1R and G1RCODE.

PHRLANG: Language of the venipuncture screening questionnaire

Both English and Spanish versions of the venipuncture screening questionnaire were used. The language used depended on the preference of the examinee. Translators, either hired or friends/family members, were available for examinees who spoke neither Spanish nor English.

PKR: Poikilocytosis

See note for ANR.

PLR: Platelet count

See note for GRR.

POR: Polychromatophilia

See note for ANR.

PRR: Promyelocyte cells

See note for ANR.

PXR: Serum transferrin saturation

This value was calculated as (FER/ TIR) * 100.

RBR: RBC folate

See note for FOR.

RCR: Red blood cell count

See notes for HGR and GRR.

RUR: Serum rubella antibody

Rubella antibody data are reported both as an optical density index and in International Units. The index was calculated by subtracting the absorbance of the control well from the absorbance of the antigen well (AG-NS) and dividing the difference by the cut-off value. The cut-off value was calculated as the mean AG-NS value of duplicate 10 IU standards. The equation used was:

O.D. index = (AG-NS)/Cut-off value

An O.D. index greater than or equal to one indicates the presence of antibody.

RURUNIT: Serum rubella antibody (IU)

Rubella antibody data are reported both as an optical density index and in International Units. International Units were calculated based on a standard curve using a regression analysis of duplicate AG-NS values of 10, 40, & 100 IU standards and their squares. An International Unit value greater than or equal to 10 indicates the presence of antibody.

SAR: Serum hepatitis B surface antigen

See note for HBR.

SER: Serum selenium

Selenium values were measured on two Perkin-Elmer graphite furnace atomic absorption spectrophotometers (model 3030 and model 5100) during the six-year study. Based on a comparability study using linear models, the results generated using the Model 5100 instrument (from 12/07/90 to 1/13/95) were on average 4.3 percent higher than those from the Model 3030 instrument (used from 10/1/88 to 12/06/90). Since the Model 5100 represented more precise measurements, the model 3030 data were adjusted to make them comparable to the Model 5100. Perkin-Elmer Model 5100 Zeeman-corrected graphite furnace atomic absorption spectrophotometer testing began on 12/07/90. All selenium values measured prior to 12/07/90 were adjusted to the AA5100 values. The formula used was:

New value = 16.795 + 0.902 * original value.

SFR: Serum iron

This value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result from the reference method (FER), rather than the SFR value, is generally recommended. For most analyses of serum iron, the appropriate variable to use will be FER. The value from the biochemistry profile (SFR) should not be used routinely. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for details. Laboratory test results for SFR were added to the protocol after NHANES III began. This result field was blank-filled for examinees who were examined prior to the start of testing.

SGR: Serum glucose

This value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result for plasma glucose from the reference method (G1R), rather than the SGR value, is generally recommended. For most analyses, the appropriate variable to use will

be G1R. The value from the biochemistry profile (SGR) should not be used routinely. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for details.

SHR: Spherocytosis

See note for ANR.

SIR: Sickle cells

See note for ANR.

SSR: Serum hepatitis B surface antibody

See note for HBR.

TGR: Serum triglycerides

Serum triglyceride levels were measured regardless of the examinee's fasting status. Mean serum triglycerides and the distribution of serum triglycerides should be estimated only on examinees who did fast at least nine hours, were examined in the morning, and were randomly assigned to the morning fasting sample (WTPFHSD6 > 0). For the purpose of this calculation, the number of hours fasted was rounded to the nearest whole integer. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for details.

TOR: Serum toxoplasmosis antibody

The presence and quantity of antibody to Toxoplasma gondii in the test sample were determined by comparing the optical density of the test sample to a standard curve. A standard curve was constructed using optical density readings from positive control sera obtained from a kit; these readings were calibrated to WHO Toxo 60 serum and read as International Units (IU/mL). Those test samples exhibiting titer below 7 IU/mL indicated a non-significant level of antibody according to this technique; thus, they were considered to be negative, indicating no infection. Those test samples with results greater than 6 IU/mL were considered to be positive, indicating infection at some undetermined time.

TRR: Serum triglycerides

This value was obtained from the standard battery of biochemical assessments. Use of the laboratory test result from the reference method (TGR), rather than the TRR value, is generally recommended. For most analyses, the appropriate variable to use is TGR. The value from the biochemistry profile (TRR) should not be used routinely. Consult the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996) for details. Results for TRR were added to the protocol after NHANES III began. This result field was blank-filled for examinees who were

examined prior to the start of testing.

TTR: Target cells

See note for ANR.

TXR: Toxic granulation

See note for ANR.

URR: Urinary creatinine

Although the laboratory method detection limit for urinary creatinine is 1 mg/dL, all values below 10 mg/dL were considered "statistically suspect" and were coded as "below level of detection".

VCR: Serum vitamin C

For NHANES III, serum concentrations of vitamin C were measured using a total vitamin C, fully reduced method using high-performance liquid chromatography with electrochemical detection (HPLC-EC) analysis. This method differed from the 2,4-dinitrophenyl hydrazine colorimetric method used in the NHANES II study. A comparison study of the two methods was carried out. Linear regression analysis, by an error in both variables' technique, was used to compare the results obtained by the two methods; values for slope, intercept, and correlation coefficient were 0.881, 0.036, and 0.927, respectively, for 138 singlet analyses.

Serum concentrations obtained by HPLC-EC were lower than those obtained by the 2,4-DNPH method. This difference was expected due to the increased specificity of the HPLC method. Unlike colorimetric methods, HPLC separates uric acid and other potential interferers from ascorbate, thereby increasing accuracy and specificity. The 2,4-DNPH method also measured endogenous diketogulonate, the product of the irreversible oxidation of dehydroascorbic acid. This species was not measured by most HPLC methods and generally was not included in total vitamin C measurements since it has no vitamin C activity. Because the laboratory method differed between NHANES III and NHANES II, the results from the two surveys are not comparable.

Blocks of vitamin C data are missing due to an inadvertent misdilution of the ascorbic acid-serum ratio.

VER: Serum vitamin E

The vitamin E value of 9999 was confirmed.

VRR: Serum varicella antibody

Varicella antibody data were reported as an optical density index.

See note RUR for the index calculation. The equation used was:

O.D. index = (AG-NS)/Cut-off value

The cut-off value was 0.1. An O.D. index equal to or greater than one indicates the presence of antibody.

VUR: Vacuolated cells

See note for ANR.

WCR: White blood cell count

See note for HGR and GRR.

Appendix 1. Blood and Urine Assessments by Specimen Type and Age Group

AGE GROUP		
1-3 years	4-5 years	6-11 years
	Whole blood	
CBC (1)(5)	CBC (1) (5)	CBC (1) (5)
Differential smear	Differential smear	Differential smear
Lead (5)	Lead (5)	Lead (5)
Protoporphyrin (5)	Protoporphyrin (5)	Protoporphyrin (5)
	RBC folate	RBC folate
	Glycated hemoglobin (5)	Glycated hemoglobin (5)
	Serum	
Iron (5)	Iron (5)	Iron (5)
TIBC (5)	TIBC (5)	TIBC (5)
Ferritin (5)	Ferritin (5)	Ferritin (5)
	Folate (5)	Folate (5)
	Apolipoprotein AI(4)(5)	Apolipoprotein AI(4)(5)
	Apolipoprotein B(4)(5)	Apolipoprotein B(4)(5)
	Cholesterol (5)	Cholesterol (5)
	HDL/LDL (5)	HDL/LDL (5)
	Triglycerides (5)	Triglycerides (5)
	Lp(a)(2)(5)	Lp(a)(2)(5)
	Cotinine (4)	Cotinine (4)
	C-reactive protein (5)	C-reactive protein (5)
	Vitamin A (5)	Vitamin A (5)
	Carotenes (5)	Carotenes (5)
	Retinyl esters (5)	Retinyl esters (5)
	Vitamin E (5)	Vitamin E (5)
	Vitamin B12 (2)	Vitamin B12 (2)
		Helicobacter pylori (4)
	Tetanus	Tetanus
		Vitamin C
		Hepatitis A

Appendix 1. Blood and Urine Assessments by Specimen Type and Age Group (continued)

AGE GROUP		
1-3 years	4-5 years	6-11 years
	Serum (continued)	
		Hepatitis B/delta
		Hepatitis C
		Hepatitis E
		Rubella (5)
		Varicella (5)
	Urine	
		Cadmium
		Creatinine
		Albumin
		Iodine

Appendix 1. Blood and Urine Assessments by Specimen Type and Age Group (continued)

AGE GROUP	
12-19 years	20 years and older
Whole blood	
CBC (1)(5)	CBC (1)(5)
Differential smear	Differential smear
Lead (5)	Lead (5)
Protoporphyrin (5)	Protoporphyrin (5)
	RBC folate
Glycated hemoglobin (5)	Glycated hemoglobin (5)
Serum	
Iron (5)	Iron (5)
TIBC (5)	TIBC (5)
Ferritin (5)	Ferritin (5)
Folate (5)	Folate (5)
Apolipoprotein AI(4)(5)	Apolipoprotein AI(4)(5)
Apolipoprotein B(4)(5)	Apolipoprotein B(4)(5)
Cholesterol (5)	Cholesterol (5)
HDL/LDL (5)	HDL/LDL (5)
Triglycerides (5)	Triglycerides (5)
Lp(a)(2)(5)	Lp(a)(2)(5)
Cotinine (4)	Cotinine (4)
C-reactive protein (5)	C-reactive protein (5)
	Rheumatoid factor (60+)
Vitamin A (5)	Vitamin A (5)
Carotenes (5)	Carotenes (5)
Retinyl esters (5)	Retinyl esters (5)
Vitamin E (5)	Vitamin E (5)
Vitamin B12 (2)	Vitamin B12 (2)
Helicobacter pylori (4)	
Tetanus	Tetanus
Vitamin C	Vitamin C
Hepatitis A	Hepatitis A
Hepatitis B/delta	Hepatitis B/delta
Hepatitis C	Hepatitis C
Hepatitis E	Hepatitis E
Rubella (5)	Rubella (5)
Varicella (5)	Varicella (5)

Appendix 1. Blood and Urine Assessments by Specimen Type and Age Group (continued)

AGE GROUP	
12-19 years	20 years and older
Serum	
Diphtheria	Diptheria
Herpes simplex I and II	Herpes simplex I and II
HIV I (ages 18+)(3)(5)	HIV I (ages 18+)(3)(5)
Toxoplasmosis (5)	Toxoplasmosis (5)
Vitamin D (OHD)	Vitamin D (OHD)
Total/normalized calcium	Total/normalized calcium
Selenium (5)	Selenium (5)
Thyroxine (T4)	Thyroxine (T4)
Thyroid-stimulating hormone	Thyroid-stimulating hormone
Antithyroglobulin antibodies	Antithyroglobulin antibodies
Antimicrosomal antibodies	Antimicrosomal antibodies
	FSH/LH (females aged 35-60 years)
	Insulin (6)
	C-peptide (6)
Biochemistry profile (5)	Biochemistry profile (5)
Bicarbonate	Bicarbonate
Blood urea nitrogen	Blood urea nitrogen
Total bilirubin	Total bilirubin
Alkaline phosphatase	Alkaline phosphatase
Cholesterol	Cholesterol
AST	AST
ALT	ALT
LDH	LDH
GGT	GGT
Total protein	Total protein
Albumin	Albumin
Creatinine	Creatinine
Glucose	Glucose
Calcium	Calcium
Chloride	Chloride
Uric acid	Uric acid
Phosphorus	Phosphorus
Sodium	Sodium
Potassium	Potassium
Triglycerides	Triglycerides
Globulin	Globulin
Iron	Iron
Osmolality	Osmolality

Appendix 1. Blood and Urine Assessments by Specimen Type and Age Group (continued)

AGE GROUP	
12-19 years	20 years and older
Plasma	
	Glucose (examinees aged 20-39 years and 75 years and older) OGTT (examinees aged 40-74 years) Fibrinogen (examinees aged 40 years and older)(5)
Urine	
Cadmium	Cadmium
Creatinine	Creatinine
Albumin	Albumin
Iodine	Iodine
Urine drug (ages 18 years and over)(2)(3)	Urine drug (examinees aged 18 years and over)(2)(3)
Cocaine	Cocaine
Opiates	Opiates
Phencyclidine	Phencyclidine
Amphetamines	Amphetamines
Marijuana	Marijuana
	Pregnancy test (females aged 20-59 years)
White Cells	
Storage/banking (5)	Storage/banking (5)

(1) Includes hematocrit, hemoglobin, red, white and platelet cell counts, mean cell volume, mean cell hemoglobin, mean cell hemoglobin concentration, red cell distribution width, platelet distribution width, mean platelet volume, and 3-cell differential
(2) Phase 2 only
(3) Anonymous
(4) Phase 1 only
(5) Home examination also
(6) In phase 2, also from second venipuncture for examinees aged 40-74 years

Appendix 2. Laboratory Test Detection Limits

Test	Detection limit
Albumin (urine)	0.5 ug/mL
Alpha carotene	0 ug/dL
Antimicrosomal antibody (AMA)	0.5 U/mL
Antithyroglobulin antibody (ATA)	1.0 U/mL
Beta carotene	0.67 ug/dL
Beta cryptoxanthin	0 ug/dL
C-peptide	0.03 pmol/mL
C-reactive protein	0.3 mg/dL
Cadmium (urine)	0.01 ng/mL
Cotinine	0.05 ng/mL
Creatinine (urine)	1 mg/dL
Erythrocyte protoporphyrin	2.5 ug/dL RBC
Ferritin	3 ng/mL
Folate (serum)	0.2 ng/mL
Follicle stimulating hormone (FSH)	0.15 IU/L
Glucose	2 mg/dL
Glycated hemoglobin	0 %
Hematology parameters	
Granulocyte	0 %
Granulocyte (1)	0 number
Hematocrit	0 %
Hemoglobin	0 g/dL
Lymphocyte	0 %
Lymphocyte (1)	0 number
Mean cell hemoglobin	0 pg
Mean cell hemoglobin concentration	0 g/dL
Monocyte	0 %
Monocyte (1)	0 number
Platelet count (1)	0
Platelet distribution width	0 %
Red blood cell count (RBC) (1)	0
Red blood cell distribution width	0 %
White blood cell count (WBC) (1)	0
Hepatitis profile	Qualitative tests
Herpes	Qualitative tests
High density lipoprotein (HDL)	10 mg/dL
Human immunodeficiency virus (HIV)	Qualitative tests
Insulin	2.5 uU/mL
Iodine (urine)	0.2 ug/dL
Iron	3.0 ug/dL
Lead	1 ug/dL
Lipoprotein(a)	0 mg/dL
Lutein/zeaxanthin	0.43 ug/dL

Appendix 2. Laboratory Test Detection Limits (continued)

Test	Detection limit
Luteinizing hormone (LH)	0.15 IU/L
Lycopene	0.63 ug/dL
Normalized calcium	0.5 mmol/L
RBC folate	4.4 ng/mL
Retinyl esters	0 ug/dL
Rheumatoid factor	Qualitative tests
Rubella	0 IU
Selenium	8 ng/mL
Tetanus	0 U/mL
Thyroid stimulating hormone (TSH)	0.01 mU/mL
Thyroxine (T4)	1.0 ug/dL
Total iron binding capacity (TIBC)	9 ug/dL
Total cholesterol	10 mg/dL
Total calcium	1.5 mmol/L
Toxoplasmosis	0 IU
Triglycerides	10 mg/dL
Varicella	0
Vitamin B12	20 pg/mL
Vitamin E	20 ug/dL
Vitamin C	0 mg/dL
Vitamin A	0.5 ug/dL
Vitamin D	5.0 ng/mL

(1) Units for white blood cell count, red blood cell count, platelet count, lymphocyte number, granulocyte number, and mononuclear number are referenced in the Manual for Medical Technicians p. 5-1 (U.S. DHHS, 1996).

Note: Lower detection limits for analytes included in the general "biochemistry profile" are found in the Laboratory Procedures Used for NHANES III (U.S. DHHS, 1996).

Appendix 3. NHANES III SI Table

Test (1)	NHANES Unit	NHANES Format	Conversion Factor	SI Unit	SI Format
Alanine aminotransferase(2)	N/A	N/A	N/A	U/L	XXX
Albumin (serum) (2)	g/dL	X.X	10	g/L	XX
Albumin (urine)	ug/mL	XXXXX.XX	N/A	N/A	N/A
Alkaline phosphatase (2)	N/A	N/A	N/A	U/L	XXX
Alpha carotene	ug/dL	XXX	0.01863	umol/L	X.XX
Antimicrosomal antibody	N/A	N/A	N/A	N/A	N/A
Antithyroglobulin antibody	N/A	N/A	N/A	N/A	N/A
Apolipoprotein AI	mg/dL	XXX	0.01	g/L	X.XX
Apolipoprotein B	mg/dL	XXX	0.01	g/L	X.XX
Aspartate amino-transferase (2)	N/A	N/A	N/A	U/L	XXX
Beta carotene	ug/dL	XXX	0.01863	umol/L	XX.XX
Beta cryptoxanthin	ug/dL	XXX	0.01809	umol/L	X.XX
Bicarbonate (2)	N/A	N/A	N/A	mmol/L	XX
Bilirubin (total)(2)	mg/dL	XX.X	17.1	umol/L	XXX.XX
Blood urea nitrogen (2)	mg/dL	XXX	0.357	mmol/L	XX.XX
C-peptide	pmol/mL	XX.XXX	1	nmol/L	XX.XXX
C-reactive protein	N/A	N/A	N/A	N/A	N/A
Cadmium (urine)	ng/mL	XX.XX	8.897	nmol/L	XXX.XX
Calcium (total)	N/A	N/A	N/A	mmol/L	X.XX
Calcium (normalized)	N/A	N/A	N/A	mmol/L	X.XX
Calcium (2)	mg/dL	XX.X	0.25	mmol/L	X.XXX
Chloride (2)	N/A	N/A	N/A	mmol/L	XXX.X
Cholesterol	mg/dL	XXX	0.02586	mmol/L	XX.XX
Cholesterol (HDL)	mg/dL	XXX	0.02586	mmol/L	X.XX
Cholesterol (LDL)	mg/dL	XXX	0.02586	mmol/L	X.XX
Cholesterol (2)	mg/dL	XXX	0.02586	mmol/L	XX.XXX
Cotinine	ng/mL	XXXX.XXX	N/A	N/A	N/A
Creatinine (2)	mg/dL	XX.X	88.4	umol/L	XXXX.X
Creatinine (urine)	mg/dL	XXX.X	0.0884	mmol/L	XX.X
Diphtheria	N/A	N/A	N/A	N/A	N/A
Ferritin	ng/mL	XXXX	1	ug/L	XXXX
Fibrinogen	mg/dL	XXX	0.01	g/L	X.XX
Folate	ng/mL	XXX.X	2.266	nmol/L	XXX.X
Folate (RBC)	ng/mL	XXXX	2.266	nmol/L	XXXX.X
Follicle-stimulating hormone	N/A	N/A	N/A	IU/L	XXX.X
GGT (2)	N/A	N/A	N/A	U/L	XXXX

Appendix 3. NHANES III SI Table

Test (1)	NHANES Unit	NHANES Format	Conversion Factor	SI Unit	SI Format
Globulin (2)	g/dL	X.X	10	g/L	XX
Glucose (2)	mg/dL	XXX	0.05551	mmol/L	XX.XX
Glucose (plasma)	mg/dL	XXX.X	0.05551	mmol/L	XX.XXX
Glycated hemoglobin	%	XX.X	N/A	N/A	N/A
Helicobacter pylori	N/A	N/A	N/A	N/A	N/A
Hematocrit	%	XX.XX	0.01	L/L=1	0.XXX
Hemoglobin	g/dL	XX.XX	10	g/L	XXX.X
Hepatitis A virus	N/A	N/A	N/A	N/A	N/A
Hepatitis B core antibody (anti-HBc)	N/A	N/A	N/A	N/A	N/A
Hepatitis B surface antigen (HbsAg)	N/A	N/A	N/A	N/A	N/A
Hepatitis C virus	N/A	N/A	N/A	N/A	N/A
Hepatitis D virus	N/A	N/A	N/A	N/A	N/A
Hepatitis B surface antibody (anti-HBs)	N/A	N/A	N/A	N/A	N/A
Herpes I & II	N/A	N/A	N/A	N/A	N/A
Homocysteine	N/A	N/A	N/A	umol/L	XX.X
Human immuno-deficiency virus	N/A	N/A	N/A	N/A	N/A
Insulin	uU/mL	XXX.XX	6.0	pmol/L	XXX.XX
Iodine (urine)	ug/dL	XXX.X	N/A	N/A	N/A
Iron	ug/dL	XXX	0.1791	umol/L	XX.XX
Iron (2)	ug/dL	XXX	0.1791	umol/L	XX.X
LDH (2)	N/A	N/A	N/A	U/L	XXX
Latex antibody	IU/mL	XXXX.XX	N/A	N/A	N/A
Lead	ug/dL	XX.X	0.04826	umol/L	X.XXX
Lipoprotein(a)	mg/dL	XXX	0.01	g/L	X.XX
Lutein/zeaxanthin	ug/dL	XXX	0.01758	umol/L	X.XX
Luteinizing hormone	N/A	N/A	N/A	IU/L	XX.X
Lycopene	ug/dL	XXX	0.01863	umol/L	X.XX
Mean cell hemoglobin	N/A	N/A	N/A	pg	XX.XX
Mean cell volume	N/A	N/A	N/A	fL	XXX.XX
Mean cell hemoglobin concentration	g/dL	XX.XX	10	g/L	XXX.X
Mean platelet volume	N/A	N/A	N/A	fL	XX.XX
Methylmalonic acid	ug/dL	N/A	0.085	umol/L	N/A

Appendix 3. NHANES III SI Table (continued)

Test (1)	NHANES Unit	NHANES Format	Conversion Factor	SI Unit	SI Format
Osmolality (2)	N/A	N/A	N/A	mmol/kg	XXX
Phosphorus (2)	mg/dL	XX.X	0.3229	mmol/L	X.XXX
Platelet count (3)	N/A	XXX.X	1	N/A	XXX.X
Potassium (2)	N/A	N/A	N/A	mmol/L	X.XX
Protein (total)(2)	g/dL	XX.X	10	g/L	XXX
Protoporphyrin	ug/dL	XXXX	0.0178	umol/L	XX.XX
Red blood cell distribution width	%	XX.XX	0.01	fraction	X.XXXX
Red blood cell count (3)	N/A	X.XX	1	N/A	X.XX
Retinyl esters	ug/dL	XXX	0.03491	umol/L	X.XX
Rheumatoid factor	N/A	N/A	N/A	N/A	N/A
Rubella	N/A	N/A	N/A	N/A	N/A
Selenium	ng/mL	XXX	0.0127	nmol/L	X.XX
Sodium (2)	N/A	N/A	N/A	mmol/L	XXX.X
Tetanus	U/mL	N/A	N/A	N/A	N/A
Thyroid stimulating hormone	uU/mL	XXX.XX	1	mU/L	XXX.XX
Thyroxine	ug/dL	XX.X	12.87	nmol/L	XXX.X
Total iron binding capacity	ug/dL	XXX	0.1791	umol/L	XXX.XX
Toxoplasmosis	N/A	N/A	N/A	N/A	N/A
Triglycerides	mg/dL	XXXX	0.01129	mmol/L	XX.XX
Triglycerides (2)	mg/dL	XXXX	0.01129	mmol/L	XX.XXX
Uric acid (2)	mg/dL	XX.X	59.48	umol/L	XXX.X
Varicella	N/A	N/A	N/A	N/A	N/A
Vitamin A	ug/dL	XXX	0.03491	umol/L	X.XX
Vitamin B12	pg/mL	XXXXX	0.7378	pmol/L	XXXXX.XX
Vitamin C	mg/dL	X.XX	56.78	mmol/L	XXX.XX
Vitamin D	ng/mL	XXX.X	2.496	nmol/L	XXX.X
Vitamin E	ug/dL	XXXX	0.02322	umol/L	XXX.XX
White blood cell count (3)	N/A	XX.XX	1	N/A	XX.XX

(1) Results are based on a serum sample unless otherwise noted.
(2) Biochemistry profile
(3) Units for white blood cell count, red blood cell count, platelet count, lymphocyte number, granulocyte number, and mononuclear number are referenced in the Manual for Medical Technicians p. 5-1 (U.S. DHHS, 1996).

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