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National Health and Nutrition Examination Survey (NHANES), 2005-2006

United States Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Health Statistics

NCHS Questionnaire: Examination and Laboratory

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Dietary Interview Component
Includes 24-Hour Dietary Recall Interview and Post-Recall Questionnaires

Public Health Objectives:

Dietary factors are associated with 5 of the 10 leading causes of death in the U.S. population. NHANES is the cornerstone of the National Nutrition Monitoring and Related Research Program (NNMRRP). Policy makers and researchers require NHANES dietary data to assess the quality and adequacy of the U.S. diet in relation to health parameters, to evaluate the impact of program changes including welfare reform, legislation, food fortification policy, and child nutrition programs, and to identify target groups for public health education and awareness programs. Dietary practices and behaviors are used to evaluate the adoption of the *Dietary Guidelines for Americans* and *Five-a-Day Program* recommendations.

The objective of the component is to estimate total intake of food energy (calories), nutrients, and non-nutrient food components from foods and beverages that were consumed during the 24-hour period prior to the interview (midnight to midnight). Following the dietary recall, a short questionnaire will be administered to ascertain whether the person's intake on the previous day was usual or unusual, the source of tap water consumed, use of salt, special diet use, and frequency of fish and shellfish consumptions during the past 30 days. Subsamples of examinees will be asked questions about recent health (1-11 year olds), recent pesticide exposure (6-7 year olds) and individual food security questions (must screen in from responses to Family Questionnaire food security section). These questions are included in **Attachment A**.

Staff:

Dietary interviewer.

Protocol:

Methods:

- All NHANES examinees are eligible for the dietary interview component. A computer-assisted dietary interview software program was developed for use in the survey. The dietary interviewer records detailed information about the foods and beverages reported. Instructions will be provided to the respondent orally in English and/or Spanish. Measurement aids and visuals including charts and drawings will be used by the respondent to quantify the foods and beverages that are reported. Data files are transmitted electronically to a coding center located offsite.
- A telephone follow-up dietary interview will be scheduled 3-10 days after their MEC exam for all the examinees. A set of measuring guides (including a USDA food model booklet, a ruler, a set of household spoons, and a set of measuring cups and measuring spoons), an appointment reminder card with the date and time of the scheduled interview, and a phone contact number will be given to the participants at the end of their MEC dietary interview. The phone follow-up interview will be conducted using the same dietary interview system as used in the MEC and will be made from a telephone center located offsite.
- The interviewers will perform data retrieval by telephone when the information provided by the respondent or a proxy is incomplete; the interviewers will obtain permission from the SP or proxy to conduct data retrieval.
- Each week, dietary interviewers are asked to audio-tape an interview and send it back to the home office for review (approximately 5% of each interviewer's work). The date and session of the taped interview are randomly selected and communicated to the interviewers via email. Home office staffs will review the audio tape to monitor the quality of the interview and provide written feedback to the interviewer. Prior to the taping, interviewers will ask permission and obtain a written informed consent from the SP. If the SP is 17 years or younger, a parental consent will also be obtained. A verbal permission will also be recorded in the audio-tape once the taping begins. At the end of the taping, permission for keeping the audiotape will be

obtained from the SP. If the SP chooses not to allow the audiotape to be kept, the audiotape will be immediately destroyed in the presence of the SP. All audiotapes will be erased after the quality control review process has been completed by survey staff.

Time Allotment:

Depending on the types and numbers of foods reported in the dietary recall, the length of the interview ranges from 15-30 minutes per interview.

Health Measures:

Not applicable

Eligibility:

All survey participants are eligible for the dietary interview component. Translators may assist respondents when needed, and proxy reporting is permitted.

Exclusion Criteria:

The only circumstances that would lead to exclusion would be in instances when communication or cognitive difficulties make it impossible for the participant to provide the necessary information, and a proxy reporter is not available to complete the interview.

Justification for using vulnerable populations:

- Minors are included in this component because they are an important target population group. Dietary data are linked to other household interview and health component data and are used to track changes that occur in food and nutrient intakes over time.
- There is no reason to exclude mentally impaired or handicapped individuals because there is no contraindication.

Risks:

There is no risk associated with this component.

Report of Findings:

No findings are reported to respondents.

Attachment A. Post-Recall Questionnaire

NHANES III

REC.155 Was the amount of food that {you/NAME} ate yesterday much more than usual, usual, or much less than usual?

MUCH MORE THAN USUAL.....1
USUAL.....2
MUCH LESS THAN USUAL 3
REFUSED.....7
DON'T KNOW.....9

CSFII

REC.265 When you drink tap water, what is the main source of the tap water? Is the city water supply (community water supply); a well or rain cistern; a spring; or something else?

COMMUNITY WATER 1
A WELL OR RAIN CISTERN.....2
A SPRING 3
NEVER DRINK TAP WATER 4
REFUSED 7
DON'T KNOW 9
OTHER (SPECIFY) 91

[RECORD Drinking fountain AS COMMUNITY WATER SUPPLY.]

NHANES III

REC.325 Now I'll be asking some questions about {your/NAME's} use of table salt.
What type of salt {do you/does NAME} usually add to {your/his/her} food at the table? Would you say it is ordinary or seasoned salt, lite salt, or a salt substitute?

ORDINARY, SEA, SEASONED, OR OTHER FLAVORED SALT [includes regular iodized salt, sea salt and seasoning salts made with regular salt]	1	
LITE SALT	2	
SALT SUBSTITUTE	3	
NONE	4	(REC.335)
REFUSED	7	(REC.335)
DON'T KNOW	9	(REC.335)

NHANES III

REC.330 How often {do you/does NAME} add {REC325 ANSWER} to {your/his/her} food at the table? Is it rarely, occasionally, or very often?

RARELY,.....1
OCCASIONALLY 2
VERY OFTEN 3
REFUSED 7
DON'T KNOW 9

CSFII

REC.335 How often is ordinary salt or seasoned salt added in cooking or preparing foods in your household? Is it never, rarely, occasionally, or very often?

NEVER 1
RARELY 2
OCCASIONALLY 3
VERY OFTEN 4
REFUSED 7
DON'T KNOW 9

[THIS QUESTION APPLIES ONLY TO USE OF ORDINARY SALT OR SEASONED SALT AND NOT TO LITE SALT OR SALT SUBSTITUTES.]

CSFII

REC.340 {Are you/Is NAME} currently on any kind of diet, either to lose weight or for some other health-related reason?

YES 1
NO ..... 2 (Box 1)
REFUSED ..... 7 (Box 1)
DON'T KNOW ..... 9 (Box 1)

CSFII

REC.345 What kind of diet {are you/is NAME} on?

[READ AS NEEDED: Is it a weight loss or low calorie diet: low fat or cholesterol diet; low salt or sodium diet; sugar free or low sugar diet; low fiber diet; high fiber diet; diabetic diet; or another type of diet?]

WEIGHT LOSS OR LOW CALORIE DIET 1
LOW FAT OR CHOLESTEROL DIET 2
LOW SALT OR SODIUM DIET 3
SUGAR FREE OR LOW SUGAR DIET 4
LOW FIBER DIET 5
HIGH FIBER DIET 6
DIABETIC DIET 7
OTHER 91
(SPECIFY) _____
REFUSED 77
DON'T KNOW 99

BOX 1

IF SP < 1 YEAR OLD, GO TO BOX 2.
OTHERWISE, CONTINUE.

NHANES 1999

DRQ.361 Please look at this list of fish. During the past 30 days, did you eat any types of fish listed on this card? Include any foods that had fish in them such as sandwiches, soups, or salads.

YES 1
NO 2 (DRQ.380)
REFUSED 7 (DRQ.380)
DON'T KNOW 9 (DRQ.380)

NHANES 1999

DRQ. 370 During the past 30 days, which types of fish did you eat and how many times did you eat them?

Type listed: breaded fish products, tuna (canned or fresh), bass, catfish, cod, flatfish, haddock, mackerel, perch, pike, pollock, porgy, salmon, sardines, sea bass, shark, swordfish, trout, walleye, other type of fish and unknown type of fish.

Interviewer instruction:
Check each type of shellfish the SP reports eating, and then ask and record the number of times each type was eaten.

NHANES 1999

DRQ.380 Please look at this list of shellfish. During the past 30 days, did you eat any types of shellfish listed on this card? Include any foods that had shellfish in them such as sandwiches, soups, or salads.

YES	1	
NO	2	(Box 2)
REFUSED	7	(Box 2)
DON'T KNOW	9	(Box 2)

NHANES 1999

DRQ. 390 During the past 30 days, which types of shellfish did you eat and how many times did you eat them?

Type listed: clams, crab, crayfish (crawfish), lobster, mussels, oysters, scallops, shrimp, other shellfish (for example, octopus, squid) and unknown type of shellfish.

Interviewer instruction:
Check each type of shellfish the SP reports eating, and then ask and record the number of times each type was eaten.

BOX 2

If the response to FSQ.030 'A', 'B', 'C', 'D' or 'E' is ' often true' (code 1), 'sometimes true' (code 2), ' refuse' (code 7), 'don't know' (code 9), continue with Box 3.
Otherwise, go to Box 5.

BOX 3

If SP 16 years or older, continue;
If SP less than 12 years old, go to the second FSQ.421 listed.
Otherwise, go to the end of the section.

USDA-FNS

FSQ.401 The next questions are about whether you were always able to afford enough food in the last 30 days.

In the last 30 days, did you cut the size of your meals because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.411 In the last 30 days, did you skip meals because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.421 In the last 30 days, did you eat less than you felt you should because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.431 In the last 30 days, were you hungry but didn't eat because you couldn't afford enough food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.440 In the last 30 days, did you lose weight because you didn't have enough money for food?

Yes 1
No 2
Refused 7
Don't Know 9

BOX A

IF (FSQ401 OR FSQ411 OR FSQ421 OR FSQ431 = 1or 2) OR IF (FSQ440=1), CONTINUE;
OTHERWISE, GO TO THE END OF THE SECTION.

USDA-FNS

FSQ.451 In the last 30 days, did you not eat for a whole day because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

BOX 4

Go to the end of the section.

USDA-FNS

FSQ.421 The next questions are about whether you were always able to afford enough food for (NAME) in the last 30 days.

In the last 30 days, did (NAME) eat less than you felt (he/she) should because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.401 In the last 30 days, did you cut the size of (NAME's) meals because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.491 In the last 30 days, was (NAME) hungry but you just couldn't afford more food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

USDA-FNS

FSQ.501 In the last 30 days, did (NAME) skip a meal because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

BOX B

IF (FSQ421 OR FSQ401 OR FSQ491 OR FSQ501= 1 OR 2), CONTINUE;
OTHERWISE, GO TO THE END OF THE SECTION.

USDA-FNS

FSQ.521 In the last 30 days, did (NAME) not eat for a whole day because there wasn't enough money for food?

Often 1
Sometimes 2
Never 3
Refused 7
Don't Know 9

BOX 5

IF SP 1-11 YEARS OLD, CONTINUE.
OTHERWISE, GO TO THE END OF THE SECTION.

NHIS ACN.350

HSQ.500 The next questions are about {your/SP's} recent health during the 30 days outlined on the calendar.

Did {you/SP} have a head cold or chest cold that started during those 30 days?

YES 1
NO 2
REFUSED 7
DON'T KNOW 9

NHIS ACN.360

HSQ.510 Did {you/SP} have a stomach or intestinal illness with vomiting or diarrhea that started during those 30 days?

YES 1
NO 2
REFUSED 7
DON'T KNOW 9

NHANES III (M)

HSQ.520 Did {you/SP} have flu, pneumonia, or ear infections that started during those 30 days?

YES 1
NO 2
REFUSED 7
DON'T KNOW 9

BOX 6

IF SP 6-7 YEARS OLD, CONTINUE.
OTHERWISE, GO TO THE END OF THE SECTION.

PUQ.100 In the **past 7 days**, were any chemical products used in {your/his/her} home to control fleas, roaches, ants, termites, or other insects?

YES	1
NO	2
REFUSED	7
DON'T KNOW	9

PUQ.110 In the **past 7 days**, were any chemical products used in {your/his/her} lawn or garden to kill weeds?

CODE ‘NO’ IF THE RESPONDENT SAYS S/HE DOES NOT HAVE A LAWN OR GARDEN.

YES	1
NO	2
REFUSED	7
DON'T KNOW	9

Mobile Exam Center Components Descriptions

The following pages describe the exam components as offered in the Mobile Examination Center.

Audiometry

Public Health Objectives: Hearing loss severe enough to interfere with speech is experienced by approximately 8 percent of U.S. adults and 1 percent of children. Hearing loss at this level has consequences for quality of life, development in children, and other problems. Occupational surveys list noise as the first or second most prevalent work hazard worldwide. More than 8 million U.S. workers are exposed to average eight hour noise levels exceeding 85 dBA, and of this number 500,000 are estimated by the Occupational Safety and Health Administration (OSHA) to be exposed to 100 dBA or greater. The principal health consequence of excessive noise exposure is permanent hearing loss, and the economic consequences of hearing loss are great. Workers compensation is estimated by the Alliance of American Insurers to average $80-$100 million each year, with the number of claims increasing each year.

The hearing examination will achieve the following objectives: 1) to obtain normative data on the hearing status of the adult US population; and 2) to evaluate certain covariates that may be related to hearing loss, such as occupational exposure.

Staff:

Medical technician

Protocol:

Methods: The hearing component for NHANES will test adolescents ages 12-19 using pure tone audiometry and tympanometry. Pure tone audiometry thresholds will be obtained in both ears at 500, 1000, 2000, 3000, 4000, 6000, and 8000 hz. To detect middle ear disease, tympanometry will be conducted to provide an estimate of tympanic membrane compliance. The otoscopic exam will examine the outer ear to identify abnormalities which may require alternate audiometric procedures or influence the results obtained.

Time Allotment:

- 16 minutes

Health Measures:

- Evaluation of hearing sensitivity
- Evaluation of the physiological function of the middle ear
- Physical examination of the outer ear

Eligibility:

- Participants age 12-19

Exclusion Criteria:

- No precluding conditions for otoscopy, immittance, or audiometry

Justification for using vulnerable populations:

- There is no reason to exclude mentally impaired or handicapped individuals because there is no contraindication if they can understand exam instructions.

Risks:

- There are no known risks with the hearing examination.

Report of findings:

- MEC
  - Level 1: None
  - Level 2: MEC physician evaluates all participants with the following findings and refers as appropriate:
- Otoscopy - impacted cerumen, drainage, blood in ear canal, foreign body in ear canal
- Tympanometry- Measures of pressure, compliance and volume consistent with blocked ear canal, fluid, or perforated eardrum
  - Level 3: Classification of hearing ability based on pure-tone audiometry

Text as is appears in MEC report:

> The softest sounds you are able to hear are called hearing thresholds. Your thresholds at different frequencies (pitches) are reported in the table below. The lower pitched sounds are towards the left of the table and the higher pitched sounds are toward the right. Values of 25 dB or less are considered normal hearing.

Hearing Levels by Ear and Frequency (Air Conduction)

Frequency (Hz) 500 1000 2000 3000 4000 6000 8000

Right Ear	*999*	*999*	*999*	*999*	*999*	*999*	*999*
Left Ear	*999*	*999*	*999*	*999*	*999*	*999*	*999*

Thresholds reported in dB HL

Provide interpretation of hearing test for right ear and left ear (**see Attachment 32**) .

Provide recommendation if any threshold in either ear exceeds 25 dB HL as follows:

The audiometry test can identify a hearing problem but can not determine the cause of hearing loss. We recommend that you see a doctor regarding your hearing loss if you have not already done so.

Body Composition – Bone Density Dual-energy X-ray Absorptiometry (DXA)

Public Health Objectives:
The body composition component consists of dual-energy X-ray absorptiometry (DXA) scans of the proximal femur (hip) and lumbar spine. The femur and spine scans will provide information on bone mineral content or density
for sample persons ages 8 years and older.

Femur bone mineral density (BMD) data will address secular trends in femoral osteoporosis in the adult U.S. population since NHANES III, as called for by Objective 2.9 of Healthy People 2010. Data from the femur and spine scans will also enhance the evaluation of skeletal health in the U.S. population by providing: a) the first estimates of osteoporosis at the spine, an important site of osteoporotic fracture; b) the first national data on spine BMD for ages 8 years and older; and c) the first nationally representative data on femur BMD in individuals ages 8-19 years.

Low BMD is a major determinant of osteoporotic fracture risk. Hip fractures account for the majority of financial costs associated with osteoporotic fractures. It has been estimated that the cost of hip fractures is about $14 billion annually. Since the risk of hip fractures begins to increase exponentially after age 65, the magnitude of this problem is likely to increase dramatically over the next few decades as the population ages. Femur BMD is one of the variables included in the model to assess absolute fracture risk that is being developed by a committee of the National Osteoporosis Foundation (NOF) and International Osteoporosis Foundation (IOF).

NHANES is the only nationally representative survey that can shed light on when peak bone mass is attained and the degree of bone loss with age. Childhood and adolescence are the periods to target for intervention strategies in osteoporosis. Measurement in younger individuals will provide insight into early racial/ethnic differences in the rate of bone accretion. This information is vital to all aspects of treatment and prevention of this disease and is particularly critical to government funding of related research, medical screening, treatment, and reimbursement programs.

Measures of bone mineral content or density also will allow researchers to gain insights into age, sex, and racial/ethnic differences in the skeleton relative to other measures of body composition such as total muscle and fat mass, as well as behavioral factors such as diet and activity.

Staff:
Health technician (MEC) with radiology certification
Protocol:
Dual-energy X-ray absorptiometry delivers a small amount of radiation through a scanning arm while the participant lies in the supine position.

Time Allotment:
Eight minutes are allowed for the procedure.

Health Measures:
Bone measures also will be obtained for pelvis, left and right ribs, thoracic and lumbar spine.
- Total body tissue (gm)
- Bone mineral content (gm)

- Bone area (cm^2)
- Bone mineral density (gm/cm^2)
- Fat content (gm)
- Lean mass (gm)
- Lean mass plus bone mineral content (gm)
- Percent fat (%)

Femur scan: values are obtained for the neck, trochanter, intertrochanter, Ward's triangle, and total femur. Spine scan: values are obtained for the L1, L2, L3, and L4 vertebrae and total spine.

- Bone mineral content (gm)
- Bone area (cm^2)
- Bone mineral density (gm/cm^2)

Eligibility:
SPs who do not meet any of the safety/exclusion questions:

- Femur and lumbar spine scan: 8 years and older

Exclusion Criteria:
- Pregnancy
- History of radiographic contrast material (barium) use in past 72 hours
- Nuclear medicine studies in the past 3 days
- Weight over 300 pounds (limitation for examination table)

Risks:
Minimal risk. The total radiation dose is extremely low, 0.01 to 0.04 mrem per scan, which is within the range of background radiation and considerably less than conventional X-rays. A chest X-ray, for example, delivers a radiation dose of 40 mrem.

Justification for using vulnerable populations:
- Minors under 18 are included in the DXA assessment to obtain information on critical periods for bone accretion.
- Pregnant women will be excluded from DXA because of the radiation exposure, however minimal.
- Mentally impaired individuals will not be excluded from body composition because there is no contraindication.

Report of findings:

MEC None
NCHS
Level 1: None
Level 2: None
Level 3: Percentage body fat and bone density results

Bone mineral density (ages 20 and older) will be reported in the final report of findings sent to participants from NCHS. BMD results will not be reported to participants less than 20 of age because the reference group used for analyzing the BMD does not include persons less than 20 years.

Variables reported: Hip and spine bone mineral density (BMD) with interpretations using the T-score or Z-scores from analyzed scan. Males will be compared to a male reference dataset and females will be compared to a female reference dataset.

Body Measurements-Anthropometry

Public Health Objectives: The objectives of the body measurements or anthropometry component are: to provide nationally representative body measures data to: 1) estimate the prevalence of overweight and obesity in the U.S. population; 2) provide data to study the association between body measures and body composition; 3) study health conditions and health risk factors and conditions including cardiovascular disease, diabetes, hypertension, physical inactivity, and dietary patterns; and 4) to monitor growth and development in children. Overweight is a major public health problem in the United States. The recent increase in overweight prevalence among all sex, age, and racial-ethnic groups has been called an epidemic. NHANES is unique in collecting nationally representative measured data on body measures and composition. Body measures data from NHANES are used to provide representative reference data, set health objectives, and monitor trends. Anthropometry data have been collected with comparable methods since the first National Health Examination Survey (1960-62).

Survey Staff: Trained health technicians perform all of the NHANES body measurements using standardized examination methods and calibrated equipment. A recorder assists the examiner during the body measures exam by assuring that proper positioning is maintained during the measurement process (particularly for young children), and recording information that is entered manually into the NHANES Integrated Survey Information System (ISIS), an online data entry system used for all of the NHANES examination components.

Measurement Site and Equipment: All measurements are performed in the NHANES mobile examination centers (MECs). The body measurement component is conducted in a private room that is equipped with a floor scale, fixed stadiometer, a bench (for taking measurements in a seated position), wall mirror, infant recumbent length measuring board, and computer workstation.

Target Sample Groups for the NHANES Body Measurement Assessments: All participants are eligible for this component. The measurements vary depending on the age of the participant as follows:

Weight: all ages Recumbent length: birth through 47 months
Standing height: 2+ years Upper leg length: 8+ years
Upper arm length: 2+ months Head circumference: birth through age 6 months
Mid-upper arm circumference: 2+ months Waist circumference: 2+ years
Triceps skinfold: 2+ months
Subscapular skinfold: 2+ months

Protocol Description

Weight: The participant stands on a floor scale that is equipped with a digital read-out. For young children, a parent or guardian holds the child for the body weight measurement. The scale is "tared" (set to zero) with the parent on the scale; the child is handed to the parent and the child's weight is measured. All body weight data are captured electronically and entered into the survey database automatically.

Stature (Standing Height): Height is measured using a wall-mounted stadiometer. The device is connected to an automated data electronic database and data are entered into the survey database automatically.

Recumbent Length: Length is measured using an infantometer or measuring board. The device is connected to an automated data electronic database and data are entered into the survey database automatically.
Head circumference: A flexible, plastic, head circumference measurement tape is used to measure the head circumference of infants.

Lengths (upper arm and upper leg) and Circumferences (mid-arm and waist): All measurements are made using a steel measuring tape.

Skinfold Thickness Measurements: Sub-scapular and triceps skinfold measurements are made using skinfold calipers.

Time Allotment: Approximately 4-5 minutes, depending on the age of the subject.

Ophthalmology

Public Health Objective: The leading causes of visual impairment in the United States are primarily age-related eye diseases including cataract, diabetic retinopathy, glaucoma, and age-related macular degeneration. More than 3.4 million Americans aged 40 years or older are either blind or are visually impaired. The major causes of vision loss in older Americans are age-related macular degeneration (AMD), diabetic retinopathy, cataract and glaucoma. Visual impairment is one of the 10 most common causes of disability in America and is estimated to impose an economic burden of $38.4 billion ($22.3 in direct costs and $16.1 in indirect costs).

Age-related macular degeneration (AMD) is the leading cause of visual impairment and blindness in the U.S. among people 65 years or older. The frequency of AMD is expected to increase as the population lives longer. Population based estimates of the prevalence and severity of AMD will help allocate resources as treatment modalities become available.

Diabetic retinopathy is the leading cause of new blindness among adults age 20-74 years. It can affect almost anyone with diabetes and contribute both to individual and societal burden. With the growing epidemic of diabetes and demographic changes in the American society, vision loss and eye disease will be a growing major public health problem. Efficacious and cost-effective strategies to detect and timely treat diabetic retinopathy are available, but among people with diabetes, ocular eye examination is received only by two-thirds of people for whom the exam is recommended and varies significantly across health care settings.

Glaucoma is the leading cause of irreversible blindness and a prevalent disease associated with aging. Although glaucoma can usually be controlled by early detection and treatment, half of people with glaucoma are not diagnosed, and glaucoma is still the number one blinding disease among African Americans.

Staff:

Health technician

Protocol: Prior to the ophthalmology exam, the participant will complete the vision examination component which includes visual acuity and objective refraction. The first exam performed will be the visual field testing using Frequency Doubling Technology (FDT) to test visual field loss from glaucoma. The second exam will be performed using an ophthalmic digital imaging system (Retinal Photography) to assess the presence of retinal diseases. Data are sent to image graders on DVD for grading following a strict protocol.

Time Allotment: The average time needed to complete both exams is 18-20 minutes

Health Measures:

- Presence of diabetic retinopathy
- Presence of age-related macular degeneration
- Evaluation of visual loss from glaucoma

Eligibility:

All examined participants aged 40 years and older who do not meet any of the exclusion criteria

Exclusion criteria:

Participants with:

- Lack of light perception (as measured by question VIQ010 in the household interview)
- Severe eye infection in one or both eyes (Question VIQ110)

- Individuals wearing eye patches in both eyes (Question VIQ130)

Justification for using vulnerable populations:
Current estimates of eye disease are based on data that are 25 years old and not nationally representative. Inclusion of mentally impaired individuals and pregnant women are important for national estimates.

Risks:
The examination procedures are noninvasive and present no greater than minimal risk to subjects.

Report of findings:
Findings from the NHANES Ophthalmology component will be provided in the Final Report of Findings sent to participants 12-16 weeks after the examination. Abnormal results will be reported to participants as soon as possible, in the Early Report.

Early Report of pathology:

The Medical Officer will send a letter to the participant within 24 hours of receiving the results. Pathologies will be reported by the name of the eye condition and a brief description (refer below). A statement recommending an appointment with an eye doctor (ophthalmologist) within the next TWO MONTHS or AS SOON AS POSSIBLE will also be provided based on the condition severity.

Description of the eye pathology provided in the early report:

- Active Proliferative Retinopathy "There were changes in the retina, the back of your eye, that are often found in people with diabetes. These changes were found in (the right/the left/both) eye(s)."
- Severe Non-Proliferative Retinopathy "There were changes in the retina, the back of your eye, that are often found in people with diabetes. These changes were found in (your right/your left/both) eye(s)."
- Macular Edema "There is a swelling in the retina in the back of (your right/your left/both) eye(s), called macular edema. This swelling can cause a decrease in vision."
- Treatable Late Stage Age-Related Macular Degeneration "Signs of age-related macular degeneration were found in (your right/your left/both) eye(s). Age-related macular degeneration is a common eye disease in older people."
- Branch or Central Vein Occlusion "There appears to be a blockage or an occlusion of a small retinal blood vessel in the back of (your right/your left/both) eye(s)."
- Hollenhorst Plaque "We found a piece of cholesterol (fatty deposit) lodged in the small retinal blood vessels in the back of (your right/your left/both) eye(s) suggesting the possibility of changes in the carotid artery in your neck."
- Irregular Nevus "A choroidal nevus, a small mole, like a birthmark, was found in the back of (your right/your left/ both) eye (s). This nevus had an unusual appearance."
- Macular Hole "There is a small hole in the central part of the retina (the macula) in (the right/the left/both) eye(s). A macular hole can cause a decrease in vision. The cause of macular holes is unknown."
- Surface Wrinkling Retinopathy/Epiretinal Membrane "There is a clear layer or membrane present in the center of the retina in (your right/your left/both) eye(s) that is pulling on the retina and may be causing a decrease in vision."
- Suspicious Cup to Disc Ratio "The optic nerve (the main nerve going into the eye) in (your right/your left/both) eye(s) has changes that suggest glaucoma may be present."

Final Report of Findings:
The findings reported will be reported in two categories:

1. Visual Field Test Results

Visual field test results will be reported for each eye. The definition of a visual field abnormality (eye-specific) is any two fields on an FDT below 1% threshold level in first test, AND at least two fields below 1% threshold level in second test, AND at least one of which is the SAME field as in the first test. "We did a visual field test to find out how well you can see things peripherally or out to the side.

Your visual field test was <normal> or <outside normal limits> in your right eye, and <normal> or <outside normal limits> in your left eye. If either eye abnormal, add: This may suggest an eye problem, which should be evaluated by an eye doctor within the next two months."

2. Retinal Image Findings

In certain cases, the participant may have received a pathology notification earlier. Reported findings may be the same as the previous pathology notification or may contain additional information about other less severe conditions.

No Significant Abnormalities "No significant abnormalities were found in the back of your (right/left) eye(s)."

Ungradeable Images "Unfortunately, we were unable to evaluate the photographs of the back (the retina) of (your right/your left/either) eye."

Abnormalities Present When a condition is present, the following feedback text is provided:

. Age-related macular degeneration

- Drusen only without other signs of age-related macular degeneration "Drusen, small deposits in the retina (the back layer of your eye) were found in (your right/your left/both) eye(s). These are commonly seen as people get older."
- Early age-related macular degeneration "Early signs of age-related macular degeneration were found in (your right/your left/ both) eye(s). Age-related macular degeneration is a common disease sometimes associated with decreased vision."
- Late age-related macular degeneration "Signs of age-related macular degeneration were found in (your right/your left/both) eye(s). Age-related macular degeneration is a common eye disease in older people."
- Treatable Late Age-Related Macular Degeneration "Signs of age-related macular degeneration were found in (your right/your left/both) eye(s). Age-related macular degeneration is a common eye disease in older people." If you have not already done so, it is strongly recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible.

. Diabetic Retinopathy

- Non-Proliferative Retinopathy "There were changes in the retina, the back of your eye, that are often found in people with diabetes and occasionally in people with high blood pressure. These changes were found in (the right/the left/both) eye(s). It is recommended that you make an appointment with an eye doctor (ophthalmologist)."
- Severe Non-Proliferative Retinopathy: "There were changes in the retina, the back of your eye, that are often found in people with diabetes. These changes were found in (the right/the left/both) eye(s). If you have not already done so, it is strongly recommended that you make an appointment with an eye doctor (ophthalmologist)."
- Inactive Proliferative Retinopathy: "There were changes in the retina, the back of your eye, that are often found in people with diabetes. These changes appeared to be old and inactive and were found in (the right/the left/both) eye(s). "
- Active Proliferative Retinopathy: "There were changes in the retina, the back of your eye, that are often found in people with diabetes. These changes were found in (the right/the left/both) eye(s). If you have not already done so, it is strongly recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible."

. Macular Edema

- Macular edema, not clinically significant (no pathology notification sent): “There is a swelling in the retina in the back of (the right/the left/both) eye(s), called macular edema. This swelling can cause a decrease in vision. It is recommended that you make an appointment with an eye doctor (ophthalmologist).”
- Macular edema, not clinically significant (pathology notification sent): “There is a swelling in the retina in the back of (the right/the left/both) eye(s), called macular edema. This swelling can cause a decrease in vision. If you have not already done so, it is recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible.”
- Clinically significant macular edema: “There is a swelling in the retina in the back of (the right/the left/both) eye(s), called macular edema. This swelling can cause a decrease in vision. If you have not already done so, it is strongly recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible.”

. Branch/Central Vein Occlusion

- Branch/Central Vein Occlusion present (no pathology notification sent) “There appears to be a blockage or an occlusion of a small retinal blood vessel in the back of (your right/your left/both) eye(s). This blockage may have happened a while ago. No further evaluation is required.”
- Branch/Central Vein Occlusion present (early pathology notification sent) “There appears to be a blockage or an occlusion of a small retinal blood vessel in the back of (your right/your left/both) eye(s). If you have not already done so, it is recommended that you make an appointment with an eye doctor (ophthalmologist).”
- Branch/Central Vein Occlusion present (immediate pathology notification sent) “There appears to be a blockage or an occlusion of a small retinal blood vessel in the back of (your right/your left/both) eye(s). If you have not already done so, it is strongly recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible.”

. Hollenhorst Plaque

- Hollenhorst plaque present “We found a piece of cholesterol (fatty deposit) lodged in the small retinal blood vessels in the back of (your right/your left/both) eye(s) suggesting the possibility of changes in the carotid artery in your neck. If you have not already done so, it is recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible.”

. Nevus

- Nevus present (no pathology notification sent) “A choroidal nevus, a small mole, like a birthmark, was found in the back of (your right/your left/ both) eye (s). This should be watched periodically by your eye doctor (ophthalmologist). “
- Nevus present (no pathology notification sent) “A choroidal nevus, a small mole, like a birthmark, was found in the back of (your right/your left/ both) eye (s). This nevus had an unusual appearance. If you have not already done so, you should make an appointment with an eye doctor (ophthalmologist) as soon as possible.”

. Macular Hole

- Macular hole present (no pathology notification sent) “There is a small hole in the central part of the retina (the macula) in (the right/the left/both) eye(s). A macular hole can cause a decrease in vision. The cause of macular holes is unknown. It is recommended that you make an appointment with an eye doctor (ophthalmologist).”
- Macular hole present (pathology notification sent) “There is a small hole in the central part of the retina (the macula) in (the right/the left/both) eye(s). A macular hole can cause a decrease in vision. The cause of macular holes is unknown. If you have not already done so, it is recommended that you make an appointment with an eye doctor (ophthalmologist).”

. Large Cup to Disc Ratio

- Large cup to disc ratio $\geq$ 0.7 (pathology notification sent) “The optic nerve (the main nerve going into the eye) in (the right/the left/both) eye(s) has changes that suggest glaucoma may be present. If you are not currently being followed by an eye doctor (ophthalmologist), it is recommended that you make an appointment.”

. Surface Wrinkling Retinopathy/Epiretinal Membrane

- Surface wrinkling retinopathy-traction is present (no pathology notification sent) “There is a clear layer or membrane present in the center of the retina in (the right/the left/both) eye(s) that may be pulling on the retina and may be causing a decrease in vision. If you have noticed a change in your vision, it is recommended that you make an appointment with an eye doctor (ophthalmologist).”
- Surface wrinkling retinopathy-traction is present (pathology notification sent) “There is a clear layer or membrane present in the center of the retina in (the right/the left/both) eye(s) that is be pulling on the retina and may be causing a decrease in vision. If you have not already done so, it is strongly recommended that you make an appointment with an eye doctor (ophthalmologist) as soon as possible.”

Oral Glucose Tolerance Test (OGTT)

Public Health Objectives: Diabetes mellitus will be assessed by fasting measures of plasma glucose and an oral glucose tolerance test in examinees ages 12 years and over.

Diabetes is a large, growing, and costly public health problem in the United States and disproportionately affects racial and ethnic minorities. About 17 million Americans have diabetes and over 1 million new cases of diabetes are diagnosed each year. Diabetes is the leading cause of kidney failure, non-traumatic lower extremity amputation, and blindness in working-age adults, and an estimated $135 billion were spent on direct and indirect medical costs for diabetes in 2002. Alarmingly, type 2 diabetes (formerly considered an adult disease) is now being diagnosed in children and adolescents and there has been a large increase in diagnosed diabetes among adults less than 40 years of age.

The inclusion of OGTTs on NHANES will allow estimation of the prevalence of IGT and, thus, pre-diabetes in the U.S. population, surveillance of trends in the prevalence and awareness of these conditions, study of the risk factors for IGT and pre-diabetes, and examination of IGT as a risk factor for health conditions and mortality. Timely data on IGT and pre-diabetes are particularly important as the nation initiates efforts to prevent diabetes among persons with pre-diabetes. These data on IGT and pre-diabetes are critical to targeting, designing, and evaluating prevention efforts, such as DHHS's STEPS program and efforts by the National Diabetes Education Program.

Staff:

. Phlebotomist
. Medical Technologist
. MEC Interviewer – administers Trutol

Protocol:

. **Method:**
A fasting glucose blood test is performed on all participants 12 years and older who are examined in the morning session after a 9-hour fast. After the venipuncture, participants are asked to drink 75 milligrams of Trutol® and to have a second venipuncture 2 hours (plus or minus 15 minutes) after the first venipuncture.

. **Time Allotment:**
Depending on age, 5-10 minutes.

. **Health Measures**
o Determine a national estimate of diabetes disease prevalence (diagnosed and undiagnosed)
o Identify the risk factors of diabetes disease;

. **Eligibility:**
o Only sample participants aged 12 years or more are eligible

. **Exclusion Criteria for Blood Draw:**
o hemophilia
o receiving cancer chemotherapy

. **Additional Exclusions for the OGTT:**
o taking oral medications for diabetes
o on insulin
o pregnant
o or if they have not fasted 9 hours

. **Risks/Benefits:**
o There are minimal risks associated with this procedure. The package label for Trutol® lists the following rare but known adverse reactions: nausea, vomiting, abdominal bloating and headache. In addition, there is a rare incidence of hypoglycemia. The risks

associated with venipuncture include excessive bleeding, fainting/feeling lightheaded, hematoma, infection, and multiple punctures to identify veins. Participants eligible for OGTT will have to endure

- Management of adverse reactions

  Board certified physicians are members of the NHANES exam team. If an adverse reaction occurs, a staff member will ask the physician to evaluate the participant and provide basic medical support. The physicians are prepared to refer participants to their own physician, community clinics, or the emergency room. MEC staff is certified in American Heart Association Basic Life Support. Emergency procedure drills are conducted twice a year.

Report of Findings

- Findings form the NHANES OGTT component will be provided in the Final Report of Findings sent to participants 12-16 weeks after the examination. Abnormal results will be reported to participants as soon as possible. For any early reporting of fasting glucose and two-hour glucose results the Medical Officer will send a letter to the participant within 24 hours of receiving the results. Participants in the morning examination session get plasma glucose reported if the fasting level is $\geq$ 126(if fasting 9 hrs) or $\geq$ 200(if fasting <9 hrs).

Oral Health

Public Health Objectives: NHANES is critical for monitoring oral health status, risk factors for disease, and access to preventive and treatment services. This component will address public health significance in areas of surveillance, prevention, health promotion/disease prevention, health policy, evaluation of Federal health programs, standardization of new methods, and health and nutrition status of minorities and underserved populations. The Basic Screening Exam (BSE) will collect information on untreated caries, dental restorations, and dental sealants during the data collection cycle.

Oral health data from NHANES will be used for:

. Assessing the prevalence of major oral health diseases and conditions including dental caries and edentulism.
. Assessing dental caries prevention efforts
. Evaluating specific public health programs/new policies and initiatives
. Targeting minority/underserved populations for monitoring of health status
. Evaluating 5 Healthy People 2010 objectives related to oral health

Staff:

Health Technician/Technologist (HT)

Protocol: The oral health screening consists largely of visual examination with a limited questionnaire. The assessments are conducted using a disposable dental mirror.

. **Time Allotment:**

Depending on age, 2-4 minutes.

. **Health Measures and Eligibility:**

Only sample participants aged 5 years or more are eligible for one or more parts of the exam. The following oral health subcomponents for the examination component and the age groups of interest in parentheses are:

- o Denture Questionnaire (25 years and older);
- o Tooth Count (5 years and older);
- o Oral Health BSE (5 years and older);
- o Functional Occlusal Contacts Exam (25 years and older); and
- o Report of Findings (5 years and older)

Exclusion Criteria:

None.

. **Justification for using vulnerable populations:**

- o Minors are included in this component because they are an important target population group. Oral health findings are linked to other household interview and health component data and are used to track changes that occur in health over time.
- o There is no reason to exclude mentally impaired or handicapped individuals because there is no contraindication.

. **Risks:**

o Minimal risk – including possible discomfort:

There will be no exposure to radiation (no x-rays), hazardous material (no use of mercury) and no use of anesthetic agents.

. **Special precautions:**
  - o None.

Report of Findings:

All participants will receive general results about oral health assessment. The results will be provided in the Preliminary Report of Findings given to the participant at the conclusion of the examination and in the Final Report of Findings.

The dental examination of the National Health and Nutrition Examination Survey is not, and is not intended to be, a substitute for the examination usually given to persons seeking care from their own dentists.

Neither a dental history nor x-rays are taken, and therefore the findings are solely the result of what can be seen at the time of the examination.

MEC levels of referral:

. If there are no findings, the following text will be printed:

o Level 1: Referral Code "N" "…after inspecting your (your child's) teeth, we did not find anything requiring immediate attention. However, our inspection is not a diagnosis and you should continue visiting your dentist on a regular basis, as recommended."

. If there is at least one untreated decay lesion, the following text will be printed:

o Level 2: Referral Code "Y" "…after inspecting your (your child's) teeth, we found that you (your child) may need dental care. However, our inspection is not a diagnosis. Therefore, you should make an appointment with your dentist within the next 1-2 weeks to have a detailed examination, diagnosis, and treatment."

Physical Activity Monitor (PAM) Component

Public Health Objectives: The primary objective of the component is to assess intensity and duration of physical activity levels of U.S. children and adults. *The U.S. Surgeon General's Report on Physical Activity and Health* reported that more than 60 percent of Americans do not engage in regular physical activity and that 25 percent do not engage in any activity. The report reaffirmed the importance of regular moderate or vigorous-intensity activity. Until now, it has been difficult to assess actual physical activity levels in freeliving populations because the cost and complexity of performing the monitoring tasks required to obtain this information were prohibitive. Physical activity data on children, particularly children in the 6-11 year age group are lacking. Proxy information on physical activity levels among youth are not useful because children spend large amounts of time away from home and they also engage in sporadic periods of activity that are difficult to document, let alone quantify. Activity monitors provide a reliable, objective, and accurate method to assess the intensity and duration of physical activity levels in children and adults.

Staff: A trained health or medical technician initializes the activity monitors in the mobile examination center (MEC).

Protocol: Examined persons are asked to wear the monitor for 7 days during normal waking hours. The monitors are not waterproof and must be removed prior to swimming or bathing. The monitor is worn on a flexible waist belt and can be removed easily. After 7 days of wear, participants return the monitor by mail in a postage-paid envelope. Respondents receive $40 remuneration for returning their monitors.

Eligibility: Ambulatory subjects 6 years of age and over are asked to wear activity monitors.

Time Requirement: It takes approximately three (3) minutes to explain the component, initialize the monitor to record information, and fit the monitor belt on each subject.

Device: The ActiGraph (formerly MTI/CSA) Model 7164 accelerometer manufactured by ActiGraph, Ft. Walton Beach, FL is used. Devices are calibrated prior to use in the study. The device is worn on an elastic waist belt over the right hip (underneath clothing).

Report of findings: There is no report of findings for this component.

Physician's Exam

Public Health Objectives:

High blood pressure is a marker for the chronic condition hypertension, which is a major risk factor for premature cardiovascular, cerebrovascular, renovascular and other vascular diseases. Standardized blood pressure measurements will be used to monitor prevalence of hypertension.

Staff:

Licensed physician

Protocol:

Methods:

- Pulse: the examining physician will determine a 30 second resting pulse rate.
- Blood pressure: three systolic/diastolic BP measurements will be taken following a strict protocol.
- Cardiovascular exclusion screening questions will be asked by physician (see Cardiovascular Fitness)
- Pre-test counseling for STD/HIV testing. Physician will discuss the STD/HIV testing and assure the confidentiality of information collected. Physician will explain to the participants how they are to get their test results and will ask them to provide a password which will be used at the time of reporting results. Physician will answer any questions the participants may have about the STD or HIV testing. Attachment 34 is a brochure with information about STDs to be used by the physician.

Time Allotment:

Depends on age of sample person. Range 2-13 minutes.

Health Measures:

Blood pressure

- Pulse (bpm)

- Systolic blood pressure (mmHg)
- Diastolic blood pressure (mmHg)

Eligibility:

Sample persons who do not meet the exclusion criteria Pulse: 2 months and older Blood pressure: 8 years and older Cardiovascular fitness screening: 12-49 years STD/HIV counseling: 14-49 years of age

Exclusion Criteria:

- Blood pressure - presence of the following on both arms: rashes, gauze dressings, casts, edema, paralysis, tubes, open sores or wounds, withered arms, a-v shunts, or if blood has been drawn from arm within last week.
- Blood pressure cuff too small to fit on arm

Justification for using vulnerable populations:

- Minors are included in the pulse and blood pressure assessment because of the relevance and impact of high blood pressure in this age group.
- Mentally impaired individuals will not be excluded from the physician's exam because there is no contraindication; however the person's guardian will receive the report of findings and facilitate any referral if necessary.

Risks:

Minimal risk. Transient discomfort during blood pressure measurement.

Special precautions:

None.

Report of findings:

• MEC Pulse and Blood Pressure - Adult Level 1: Systolic BP >= 210 and/or diastolic BP >= 120; Pulse > 140 bpm Level 2: 140 < Systolic BP < 210 and/or 90 <=diastolic BP < 120 Level 3: Systolic < 140 and diastolic < 90.

Text in MEC report is as follows:

Optimal Normal Acceptable Systolic bp <value> < 120 < 130 <140 Diastolic bp <value> < 80 < 85 < 90

Resting pulse rate (all ages) <value>

Your blood pressure today is *insert statement from table below*

Systolic Diastolic Statement
< 130 < 85 within the normal range 130-139 85-90 normal but at the high end of the normal range 140-159 90-99 mildly high 160-179 100-109 moderately high 180-209 110-119 very high >210 >120 severely high

From the Sixth Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure

Children's BP levels reported as normal, high normal, high, and very high based on criteria established by the following manuscript: National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents. Update on the 1987

Task Force Report on High Blood Pressure in Children and Adolescents: A Working Group Report from the National High Blood Pressure Education Program. Pediatrics. 1996;11:649-658.

• NCHS STD/HIV - Toll free phone line for participant to call for results Level 1: None Level 2: Positive results for chlamydia, gonorrhea, Herpes type 2 or HIV. Participants will be counseled by health educator and referred for care. List of STD/HIV treatment sites will be obtained in advance for each stand and be made available for participants Level 3: Negative results for chlamydia, gonorrhea, Herpes type 2 and HIV.

Vision

Public Health Objectives: Eye diseases cause suffering, disability and loss of productivity for millions of people in the United States. In economic terms, eye disease and blindness are estimated to cost the U.S. in excess of $22 billion each year. No high-quality, up-to-date information exists on the prevalence of visual impairment and the major causes of visual impairment in the general population. These data are needed in planning health services, in monitoring changes in disease prevalence, in research program planning, in developing and testing hypotheses about eye disease etiology.

Data collected over 20 years ago in the NHANES I (self-reported history questions and full vision examination with dilation) continue to be the only source of national prevalence data on eye disease and visual acuity impairment and there are no data on visual field impairment. Changes in disease definitions, population demographics, diagnostic capabilities, and treatments for eye diseases make it important to obtain new national data about eye disease. The absence of such data has forced researchers to use blindness registry data that are almost 25 years old. These studies select mostly white populations or non-nationally representative populations.

The ophthalmic data from NHANES will be used to: 1) measure the prevalence of visual acuity impairment in the U.S. population (visual acuity worse than 20/40), by cause; 2) measure the distribution of refractive error in the U.S. population; 3) evaluate screening strategies for visual impairment and eye disease; and 4) evaluate functional impairment related to vision.

Staff:

Health technician (MEC)

Protocol:

Methods:

Best corrective vision Visual acuity is measured with an autorefractor. The examinee puts his/her chin on the chin rest and focuses on a chart with numbers and letters in the autorefractor screen. Examinee is then asked to sequentially read the largest to smallest possible line on a built-in chart in the autorefractor. The technician isolates the smallest line read by the examinee with 1 error. With the examinee's eye focused on the line, the autorefractor quickly takes three repeated measurements, which is also known as objective refraction. These three auto-retinoscopy measurements, their average, and other measurements from the objective refraction are saved in a database. If required, these readings are further fine tuned to obtain best visual acuity based on objective

refraction readings. Data from completed examinations are transferred to the ISIS and saved in a database.

Current Prescription The Lensmeter reads the current prescription of the eyeglass. This data is transferred to the autorefractor and later saved in the ISIS database to compare the current correction with the best corrective vision obtained from the auto-refractor.

Near visual acuity For the near visual acuity, older examinees are asked to read five lines of numbers and letters written on the near acuity card at the comfortable distance and this distance is measured and saved in the ISIS database.

Time Allotment: Depends on age and vision of sample person. Range 7-8 minutes. **Health**

Measures: The ophthalmic data from NHANES will be used to: 1) measure the prevalence of visual acuity impairment in the U.S. population (visual acuity worse than 20/40), by cause; 2) measure the distribution of refractive error in the U.S. population; 3) evaluate screening strategies for visual impairment and eye disease; and 4) evaluate functional impairment related to vision.

Eligibility: All sample persons aged 12+ years will have the refraction exam for the best corrective vision. Visual acuity assessment using the near card will be performed only on persons 50 years and over.

Exclusion Criteria:

Any evidence of injury (eye patch or bandage) or severe infection (i.e., purulent discharge with redness in eye) in both eyes.

Justification for using vulnerable populations:

- In recent years, myopia has been rapidly increasing in the U.S., especially among young adults and impaired vision is a major cause of motor vehicle accidents among older persons.
- Minors are included in this component because they are an important target population group. Visual acuity will be linked to other household interview and health component data and are used to monitor trends for impairment.
- Mentally impaired individuals will be tested if they can follow instructions.

Risks:

None. No mydriadic or anesthetic agents will be used

Report of Findings:

- MEC:

  Level 1: None
  Level 2: None
  Level 3: Visual acuity with recommendation

Text in MEC report is as follows:

We have done a quick check of your vision today. Our exam is not as precise as an eye exam done by an eye doctor. These values may differ from a vision exam you may have

by an ophthalmologist, optometrist or optician

For vision 20/25 or better in both eyes with their current correction (either no correction, distance glasses and/or contact lenses):

Your distance vision is 20/__ in your right eye and 20/__ in your left eye with _____. This is a good level of vision. You should continue your usual schedule of periodic examinations by your eye doctor.

For vision worse than 20/25 in either eye with their current correction (either no correction, distance glasses and/or contact lenses) :

Your distance vision is 20/__ in your right eye and 20/__ in your left eye with _____. This level of vision is not as good as most people's. If you were not already aware of this, you should see an eye doctor to see if he/she can improve your vision. Your eye doctor can also provide you with a full eye examination.

Blood and Urine Collection

Venipuncture

Public Health Objectives:

Venipuncture is performed to obtain laboratory results that provide prevalence estimates of disease, risk factors for exam components, and baseline information on health and nutritional status of the population.

Staff:

Certified Phlebotomist

Protocol:

Methods:

Blood is drawn from the examinee's arm. In the laboratory the blood is processed, stored and shipped to various laboratories for analysis. The complete blood count (CBC) results are reported in the MEC and all other results are reported from NCHS to the participant.

The volume of blood drawn by age follows.

- 1-2 years, 9 ml (0.3 ounces), 0.6 tablespoons
- 3-5 years, 20 ml (0.7 ounces), 1.3 tablespoons
- 6-11 years, 35 ml (1.1 ounces), 2.3 tablespoons
- 12+ 104 ml (3.4 ounces), 7.0 tablespoons

Time Allotment:

Depending on age of participant. Range 5-10 minutes.

Health Measures:

Laboratory test results.

Eligibility:

Sample persons aged 1 year and older who do not meet any of the exclusion criteria.

Exclusion Criteria:

- Hemophiliacs
- Participants who received chemotherapy within last 4 weeks
- The presence of the following on both arms: rashes, gauze dressings, casts, edema, paralysis, tubes, open sores or wounds, withered arms

or limbs missing, damaged, sclerosed or occluded veins, allergies to cleansing reagents, burned or scarred tissue, shunt or IV.

Justification for using vulnerable populations:

- Minors are included in this component because they are an important target population group. Laboratory data are linked to other household interview and health component data and are used to track changes that occur in health over time.
- There is no reason to exclude mentally impaired or handicapped individuals because there is no contraindication.

Risks:

The following are known risks associated with venipuncture:

- Hematoma
- Swelling, tenderness and inflammation at the site
- Persistent bleeding
- Vasovagal response - dizziness, sweating, coldness of skin, numbness and tingling of hands and feet, nausea, vomiting, possible visual disturbance, syncope and injury fall from fainting.

Rare adverse effects:

- Thrombosis of the vein due to trauma.
- Infection which results in thrombophlebitis.

Special precautions:

- Sterile equipment issued with all sample persons.
- Physician on call in case an adverse affect occurs.

Report of Findings:

Reported in the MEC:

Complete Blood Count (CBC)

Reported from NCHS:

Other laboratory results

Urine Collection

Public Health Objectives:

Urine is collected to obtain laboratory results that provide prevalence estimates of disease, risk factors for exam components, and baseline information on health and nutritional status of the population.

Staff:

MEC Coordinator

Protocol:

Methods:

Urine is collected from individuals aged 6 years and above.

Time Allotment:

2 minutes

Health Measures:

Laboratory test results.

Eligibility:

Sample persons aged 6 years and above.

Exclusion Criteria:

None

Justification for using vulnerable populations:

- Minors are included in this component because they are an important target population group. Laboratory data are linked to other household interview and health component data and are used to track changes that occur in health over time.
- There is no reason to exclude mentally impaired or handicapped individuals because there is no contraindication.

Risks:

None

Special precautions:

None

Report of Findings:

Reported in the MEC: Pregnancy Test
Reported from NCHS: Other laboratory results

Bone Mineral Status Markers

Laboratory Measures:

Vitamin D and serum parathyroid hormone

Public Health Objectives:

Evaluation of bone mineral status will utilize an evaluation of vitamin D status based on two analytes: serum 25-hydroxyvitamin D and parathyroid hormone. Vitamin D is essential for active intestinal calcium absorption and plays a central role in maintaining calcium homeostasis and skeletal integrity. In addition, vitamin D has recently been linked to other non-skeletal conditions of public health significance, such as hypertension, and cancer. Vitamin D is derived mainly from cutaneous synthesis in the presence of ultraviolet sunlight while dietary intake constitutes a minor fraction. Serum 25(OH) D is the best indicator of vitamin D status. It is converted in the kidney, stimulated by parathyroid hormone (PTH), to the hormonally active metabolite 1,25-dihydroxyvitamin D (1,25 (OH)2D). Serum parathyroid hormone concentration is a very sensitive indicator of calcium homeostasis and vitamin D deficiency. The inclusion of this measure to the NHANES laboratory protocol will increase the usefulness of the vitamins D measurement in evaluating vitamin D status particularly as it relates to skeletal status. The inclusion of both these markers in the NHANES survey will provide a more complete picture of vitamin D status.

Inclusion of serum 25(OH)D in NHANES will allow us to continue to assess vitamin D status in the population, while inclusion of PTH will help us better interpret the meaning of low 25(OH)D values in various groups. Interest in vitamin D status in the US has increased significantly in recent year. For example, questions have been raised recently about the extent of vitamin D deficiency and insufficiency in the U.S. population. Furthermore, the adequacy of the 1997 Dietary Reference Intake recommendations for vitamin D in the U.S. are now being questioned, especially since new data suggests that optimal serum 25(OH)D levels may be noticeably higher than previously thought. Finally, recent studies have clarified that rickets still occurs in the U.S. Thus, it is important to include these two measures of vitamin D status in the NHANES survey. In addition, these measures can be linked with other measures included in the survey, such as blood pressure and bone mineral density, in order to evaluate its role in both skeletal and nonskeletal conditions.

It has been estimated that the annual cost of osteoporosis is about $10 billion. The magnitude of this problem is likely to increase dramatically over the next few decades as the population ages. The

risk of hip fractures (the most costly fractures in terms of morbidity, mortality and health care costs) begins to increase exponentially after age 65.

Important pieces of data are not currently available about the changes in bone mass in the population, especially in minority populations. There are no data on total body bone measures from a nationally representative sample. Measures of total body bone mineral content or density will allow researchers to gain insights into age, sex, and racial/ethnic differences in the skeleton relative to other measures of body composition such as total muscle and fat mass, as well as behavioral factors such as diet and activity.

Childhood and adolescence are the periods to target for intervention strategies in osteoporosis. Measurement in younger individuals will provide insight into early racial/ethnic differences in the rate of bone accretion. Furthermore, correlation of DXA measures with bone markers over age can provide information about the utility of these markers as surrogates for bone density or content when seeking age of peak bone mass or indicators of high or low bone turnover. This information is crucial to understanding when the best and most effective dietary intervention can be implemented to maximize peak bone mass.

NHANES is the only nationally representative survey that can shed light on when peak bone mass is attained and the degree of total body bone loss with age. This information is vital to all aspects of treatment and prevention of this disease and is particularly critical to government funding of related research, medical screening, treatment, and reimbursement programs.

Data on bone status and its relationship to age among racial ethnic groups can be used to target osteoporosis prevention programs to the most important age groups. The data from the DXA scans and the bone marker studies will also provide important reference distributions and allow studies of the association between bone status, diet, activity, and other body composition measures.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings Level		
			1	2	3
Vitamin D	1 and older	300-500 uL			
Parathyroid hormone	6 and older	1 mL		Yes	Yes

Vitamin D deficiency leads to a decrease in calcium absorption in the gastrointestinal tract and overproduction of parathyroid hormone.

Increased PTH may also be found with other conditions such as hyperthyroidism, malabsorption and some cancers. PTH levels outside the normal range will be reported to NHANES participants.

Normal ranges: age <45 years: 10-45 pg/ml [intact immunoradiometric assay (IRMA)]

Age 45+: 10-65 pg/ml references ranges.

Diabetes Profile

Laboratory Measures:

Fasting Glucose, Insulin, and Glycohemoglobin

Public Health Objectives:

Diabetes mellitus will be assessed by fasting measures of plasma glucose, insulin, c-peptide and glycohemoglobin in 12 years and over.

Diabetes is a large, growing, and costly public health problem in the United States and disproportionately affects racial and ethnic minorities. About 17 million Americans have diabetes and over 1 million new cases of diabetes are diagnosed each year. Diabetes is the leading cause of kidney failure, non- traumatic lower extremity amputation, and blindness in working-age adults, and an estimated $135 billion were spent on direct and indirect medical costs for diabetes in 2002. Alarmingly, type 2 diabetes (formerly considered an adult disease) is now being diagnosed in children and adolescents and there has been a large increase in diagnosed diabetes among adults <40 years of age.

Information on the prevalence of diabetes disease, especially in its early stages, and associated risk factors will be used to help develop early intervention and prevention programs for the disabling consequences of this condition.

Specifically, the diabetes disease examination will provide population data to:

1. determine a national estimate of diabetes disease prevalence (diagnosed and undiagnosed), including those at high risk for the late complications of the disease;
2. identify the risk factors of diabetes disease;
3. permit a national cohort to be established for follow-up studies of this condition; and
4. provide critical information to clinicians and public health officials for the development of preventive care and community-based interventions.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings Level		
			1	2	3
Glucose	12 and older	500 uL		Yes	Yes
Insulin	12 and older	1 mL			
Glycohemoglobin	12 and older	400uL		Yes	Yes

Infectious Disease Profile

Laboratory Measures:

Hepatitis virus

Public Health Objectives:

Hepatitis viruses

Viruses that primarily infect the liver constitute a major public health problem because of the morbidity and mortality associated with the acute and chronic consequences of these infections. New immunization strategies have been developed to eliminate transmission of hepatitis B and hepatitis A viruses in the United States. Because of the high rate of asymptomatic infection with both viruses, NHANES will provide the best means for determining the age-specific effectiveness of immunization strategies to prevent these infections. In addition, NHANES provides the means to better define the epidemiology of hepatitis viruses that were recently characterized, such as hepatitis C and G virus along with D and possibly F. In NHANES testing for markers of infection with the hepatitis viruses will be used to determine secular trends in infection rates across most age and racial/ethnic groups, and will provide a national picture of the epidemiologic determinants of these infections.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings Level		
			1	2	3
Hepatitis virus	6+	200 ml, 1.5 ml		Yes	

Miscellaneous Laboratory Assays

Laboratory Measures:

C-reactive protein, Standard Biochemical Profile includes Alanine Aminotransferase (ALT), Albumin, Alkaline Phosphatase (ALP), Aspartate Aminotransferase (AST), Bicarbonate (HCO_3), Blood Urea Nitrogen (BUN), Calcium, Cholesterol, Creatinine, Gamma Glutamyltransaminase (γ-GT), Glucose, Iron, Lactate Dehydrogenase (LDH), Phosphorus, Sodium, Potassium, and Chloride, Total Bilirubin, Total Protein, Triglycerides, and Uric Acid.

Public Health Objectives:

C-reactive protein

C-reactive protein is considered to be one of the best measures of the acute phase response to an infectious disease or other cause of tissue damage and inflammation. It is used to correct the iron status measures which are affected by inflammation. It can also be used to measure the body's response to inflammation from chronic conditions, such as arthritis, and environmental exposures to agents such as tobacco smoke.

Standard biochemical profile

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

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

B. Albumin
   Albumin measurements are used in the diagnosis and treatment of numerous diseases primarily involving the liver or kidneys.

C. Alkaline Phosphatase (ALP)
Increased ALP activity is associated with two groups of diseases: those affecting liver function and those involving osteoblastic activity in the bones. In hepatic disease, an increase in ALP activity is generally accepted as an indication of biliary obstruction. An increase in serum phosphatase activity is associated with primary hyperparathyroidism, secondary hyperparathyroidism owing to chronic renal disease, rickets, and osteitis deformans juvenilia due to vitamin D deficiency and malabsorption or renal tubular dystrophies. Increased levels of ALP are also associated with Von Recklinghausen's disease with bone involvement and malignant infiltrations of bone. Low levels are associated with hyperthyroidism, and with the rare condition of idiopathic hypophosphatasia associated with rickets and the excretion of excess phosphatidyl ethanolamine in the urine.

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

E. Bicarbonate (HCO_3)
Together with pH determination, bicarbonate measurements are used in the diagnosis and treatment of numerous potentially serious disorders associated with acid-base imbalance in the respiratory and metabolic systems.

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

G. Calcium
Elevated total serum calcium levels are associated with idiopathic hypercalcemia, vitamin D intoxication, hyperparathyroidism, sarcoidosis, pneumocystic carinii pneumonia and blue diaper syndrome. Low calcium levels are associated with hypoparathyroidism, pseudohypoparathyroidism, chronic renal failure, rickets, infantile tetany, and steroid therapy.

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

I. Creatinine
Creatinine measurement serves as a test for normal glomerular filtration. Elevated levels are associated with acute and chronic renal insufficiency and urinary tract obstruction. Levels below 0.6 mg/dL are of no significance.

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

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

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

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

N. Phosphorus
There is a reciprocal relationship between serum calcium and inorganic phosphorus. Any increase in the level of inorganic phosphorus causes a decrease in the calcium level by a mechanism not clearly understood. Hyperphosphatemia is associated with vitamin D hypervitaminosis, hypoparathyroidism, and renal failure. Hypophosphatemia is associated with rickets, hyperparathyroidism, and Fanconi syndrome. Measurements of inorganic phosphorus are used in the diagnosis and treatment of various disorders, including parathyroid gland and kidney diseases and vitamin D imbalance.

O. Sodium, Potassium, and Chloride
Hyponatremia (low serum sodium level) is associated with a variety of conditions, including severe polyuria, metabolic acidosis, Addison's disease, diarrhea, and renal tubular disease. Hypernatremia (increased serum sodium level) is associated with Cushing's syndrome, severe dehydration due to primary water loss, certain types of brain injury, diabetic coma after therapy with insulin, and excess treatment with sodium salts.

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

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

P. Total Bilirubin
Elevated levels are associated with hemolytic jaundice, paroxysmal hemoglobinuria, pernicious anemia, polycythemia, icterus neonatorum, internal hemorrhage, acute hemolytic anemia, malaria, and septicemia. Low bilirubin levels are associated with aplastic anemia, and certain types of secondary anemia resulting from toxic therapy for carcinoma and chronic nephritis.

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

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

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

Health Measures, Eligibility, Report of Findings:

Health Measure		Eligibility	Volume Required	Report of Findings Level		
				1	2	3
C-reactive protein		1 and older	500 uL			
Biochemistry profile		12+	800 uL			
	ALT				Yes	Yes
	AST				Yes	Yes
	Albumin				Yes	Yes
	Alkaline Phosphatase					Yes
	Bicarbonate (HCO_3)				Yes	Yes
	BUN				Yes	Yes
	Calcium				Yes	Yes
	Cholesterol					
	Creatinine				Yes	Yes
	GGT					Yes
	Glucose				Yes*	Yes*
	Iron					Yes*
	LDH					Yes
	Phosphorus				Yes	Yes
	Sodium				Yes	Yes
	Potassium Chloride				Yes	Yes
	Total Bilirubin				Yes	Yes
	Total Protein				Yes	Yes
	Triglycerides				Yes*	Yes*
	Uric Acid				Yes	Yes

* Value may be reported from different assay

Kidney Disease Profile

Laboratory Measures:

Serum creatinine, blood urea nitrogen, urinary albumin and creatinine

Public Health Objectives:

The purpose of the kidney and urologic diseases portion of the NHANES is to determine prevalence of specific nephrologic and urologic conditions in the population; to determine the association between health conditions such as diabetes and hypertension and the development of kidney and urologic diseases; to monitor trends in the prevalence of these diseases and their risk factors over time. These data will be used to assist in planning for initiatives and other programs for the prevention and treatment of nephrologic and urologic diseases.

Blood specimens will be used to obtain measures of serum creatinine, blood urea nitrogen, urinary albumin and creatinine will be measured. Self-reported information on chronic analgesic use and incontinence will be collected.

The incidence of end stage kidney failure is increasing rapidly in the U.S. in adults of all age groups which implies that the prevalence of progressive renal impairment is also increasing. However, little information is known about the prevalence of chronic renal impairment on a national level. Urologic disease, including urinary incontinence affects a large proportion of the population. Little nationally representative data on the prevalence and risk factors associated with these conditions are available.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings level		
			1	2	3
Serum Creatinine/blood urea nitrogen	12 and older	1 mL		Yes	Yes
Urinary albumin and creatinine	6 and older	3 mL			

Pregnancy Test and Prostate Specific Antigen (PSA)

Laboratory Measures:

Pregnancy test, PSA

Public Health Objectives:

Pregnancy test

Information on current pregnancy status will be used to exclude participants from the DXA examination and for interpretation of current nutritional status and body measures.

PSA test

Prostate cancer is the most common non-skin malignancy among men with approximately 180,000 new cases diagnosed and 37,000 deaths in 1999. The total and free PSA tests have been recognized as tumor markers for the screening, diagnosis and management of prostate cancer. The total PSA is not specific for prostate cancer. Mildly elevated total PSA (above the cutoff of 4 ng/mL) can be seen in benign prostatic hypertrophy and prostatitis. Falsely low PSA may be seen in men treated with finasteride or taking herbals such as Saw Palmetto. The more recent free PSA assay is recommended to increase the specificity when the total PSA is between 4-10 ng/mL. A percent free PSA (free/total PSA X 100%) of less than 25% suggests prostate cancer

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings level		
			1	2	3
Urine: Pregnancy Test	8-59 females	1 mL			Yes
PSA Test	Males 40+	1 ml		Yes	Yes

Report of Findings:

PSA:

Male survey participants tested for PSA will receive test results in their Final Report of Findings. If the result is greater than 4 ng/mL, an early reporting letter will be sent.

Nutritional Biochemistries and Hematologies

Laboratory Measures:

- Complete blood count
- Erythrocyte protoporphyrin
- Serum folate
- RBC folate
- Serum iron & TIBC
- Serum ferritin
- Transferrin receptor (TfR)
- Transferrin saturation (TS) (calculated from iron and TIBC)
- Serum vitamin C
- Serum vitamin A/E/carotenoids
- Plasma homocysteine
- Serum vitamin B_{12}
- Serum vitamin B_6

Public Health Objectives:

The objectives of this component are to:

1) Provide data for monitoring secular trends in measures of nutritional status in the U.S. population;
2) Evaluate the effect of people's habits and behaviors such as physical activity and the use of alcohol, tobacco, and dietary supplements on people's nutritional status; and
3) Evaluate the effect of changes in nutrition and public health policies including welfare reform legislation, food fortification policy, and child nutrition programs on the nutritional status of the U.S. population.

These data will be used to estimate deficiencies and toxicities of specific nutrients in the population and subgroups, to provide population reference data, and to estimate the contribution of diet, supplements, and other factors to serum levels of nutrients. Data will be used for research to further define nutrient requirements as well as optimal levels for disease prevention and health promotion.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings level		
			1	2	3
Complete blood count	1 and older	1.5 mL		Yes	Yes
Erthrocyte protoporphryin	3-5 yrs, 12-	400 uL			Yes

	49F				
Serum folate/Vitamin B_{12}	1 and older	700 uL-1 mL		Yes	Yes
Serum iron & TIBC	1 and older	100 uL		Yes	Yes
Serum ferritin/TfR	3-5 yrs, 12-59F	300-500 uL			Yes
Serum vitamin A, E, carotenoids, & retinyl esters	6 and older	400-500 uL		Yes	Yes
Vitamin C	6 and older	100 uL			
Plasma homocysteine	20 and older	1 mL			
Serum vitamin B_6	6 and older	200-500 uL			

Sexually Transmitted Disease Profile

Laboratory Measures:

Chlamydia trachomatis, Neisseria gonorrhoeae, Herpes simplex 1 and 2, HIV, Human papillomavirus virus (HPV) (antigen from vaginal swabs, females age 14- 59 years and HPV 16 antibody, all, age 14-59 years).

Public Health Objectives:

Chlamydia trachomatis and *Neisseria gonorrhoeae* (Urine Test)

Sexually transmitted infections caused by *Chlamydia trachomatis* and *Neisseria gonorrhoeae* may lead to pelvic inflammatory disease, ectopic pregnancy, infertility, and chronic pelvic pain in women. They may also increase the risk of HIV transmission in women. Pregnant women may transmit infection to their newborn causing serious medical complications. At the present the prevalence of chlamydial and gonococcal infection in the general population of the United States is unknown. NHANES offers an opportunity to assess the prevalence of chlamydial and gonococcal infection in the general population and to monitor trends in prevalence as prevention programs are established and expanded.

Herpes simplex 1 and 2 (Blood Test)

Sera from NHANES subjects ages 14-49 will be tested for antibody to Herpes simplex 1 and 2 (HSV-1/2) to continue to monitor the prevalence of HSV-1/2 infection in the U.S. HSV-1 is a common chronic infection that is associated with lower socioeconomic status. HSV-2 is an index of sexually transmitted infections. In addition, questions about those sexual behaviors that are risk factors for sexually transmitted infections and that are the focus of major national HIV and sexually transmitted diseases risk reduction efforts will be included. The joint availability of sexually transmitted infection and risk factor data in a national sample on a periodic basis is a unique and invaluable resource for evaluation of national HIV/STD risk reduction efforts and for risk-based modeling of the frequency and trends of sexually transmitted infections.

HSV-2 infections are rarely life threatening, but morbidity due to recurrent genital ulcerations is substantial. Just as important, HSV-2 infection is the best current marker of sexual behavior risk factors leading to sexually transmitted infections, generally, because: (a) HSV-2 infections are common and, thus, HSV-2 rates are a sensitive measure of sexually transmitted infection risk factors; (b) HSV-2 infection is almost always a result of sexual transmission and, thus, a specific measure of sexually transmitted infection; (c) HSV-2 infections are not curable and, thus, HSV-2 risk is not influenced by health care seeking factors; and (d) sensitive, specific, and relatively inexpensive tests for HSV-2 antibody are available. HSV-2 is a very important index of the success of large national efforts, motivated by the acquired immunodeficiency epidemic, to reduce risky sexual behaviors.

HIV antibody (Blood or Urine Test)

The estimated prevalence of human immunodeficiency virus (HIV) infection in the United States population is an important measure of the extent of the medical and financial burden the nation faces due to this virus. NHANES III data on HIV infection during 1988-94 will serve as a baseline for monitoring the changes in the epidemic over time in the general population of the United States. In addition to HIV testing in NHANES, whole blood samples will be collected and stored for future CD4 testing once the HIV status of the sample is known. This will allow CDC to determine the distribution of CD4 cells in a random sample of HIV positive individuals. NHANES is now the only national survey collecting blood on a population based sample, therefore it will be a key element in future estimates. If the participant refuses phlebotomy but does not refuse the HIV test urine will be tested for HIV antibody.

Human papillomavirus (HPV) (Vaginal swab – DNA test; Blood test for antibody HPV

Genital human papillomavirus (HPV) infection is likely the most common sexually transmitted infection in the U.S., and cervical infection with certain types of HPV, especially HPV-16, is the single strongest risk factor for cervical cancer. No surveillance systems exist for HPV infections, the majority of which are subclinical. Serum from participants age 14-59 years will be tested for antibody to HPV-16, the antigenic type most linked with cervical cancer to estimate the percentage of individuals of both genders who have ever been infected with this virus. Testing of HPV DNA from vaginal swabs from women 14-59 will provide an estimate of current infection. Vaginal swabs will be tested for HPV DNA by the FDA approved Hybrid Capture II method (Digene) and by consensus PCR with type specific analysis. The Hybrid Capture assay will detect overall high risk HPV types, but cannot identify specific types. The PCR will allow identification of specific HPV type. Participants will be notified of their Hybrid Capture results and specific messages will be developed to explain the implications of the findings based on their age group.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings Level		
			1	2	3
Chlamydia trachomatis Neisseria gonorrhoeae	14-39	10 ml		Yes	Yes
Herpes 1 and 2 antibody	14-49	200 ul		Yes	Yes
HIV antibody	18-49	500 ul		Yes	Yes
HPV	14-59	500 µL			

* Persons with positive STD or HIV findings will be referred for counseling and treatment.

Justification for using vulnerable populations:

- Teenagers are included because they are at increasing risk for STD's. A pilot study in NHANES III demonstrated an increased prevalence chlamydial infection starting at age 14 years (whites 4%, blacks 12% Mexican Americans 6%).
- Mentally impaired persons will be excluded from the STD profile due to NCHS' inability to provide adequate support and counseling to this group with the test result.

Blood Lipids

Laboratory Measures:

Total Cholesterol, HDL- Cholesterol, LDL-Cholesterol, Triglycerides

Public Health Objectives:

The goals of this component are to:

1. Monitor the prevalence and trends in major cardiovascular conditions and risk factors in the U.S.;
2. Evaluate prevention and treatment programs targeting cardiovascular disease in the U.S.

The main element of the cardiovascular disease laboratory component in NHANES is blood lipid levels. Cardiovascular disease is the leading cause of death in the United States. An estimated 4.8 million Americans have congestive heart failure. Increasing prevalence, hospitalizations, and deaths have made congestive heart failure a major chronic condition in the United States.

The data will be used to:

1. Monitor the status of hypertension prevalence, awareness, treatment and control and the success of the National HBP Education Program;
2. monitor the status of hyperlipidemia and the success of the National Cholesterol Education Program;
3. Estimate the prevalence of congestive heart failure and compare to the baseline data from the NHANES I.

Health Measures, Eligibility, Report of Findings:

Health Measure	Eligibility	Volume Required	Report of Findings Level		
			1	2	3
Total Cholesterol	3 and older	+++		Yes	Yes
HDL-Cholesterol	3 and older	+++			Yes
LDL-Cholesterol	3 and older	calculated			Yes
Triglycerides*	3 and older	+++		Yes	Yes

+++ For all four assays and 1 ml used for persons 6 years and older

These chemicals are either currently being measured or planned to be measured in blood, serum or urine specimens from NHANES by the Division of Laboratory Sciences (DLS), National Center for Environmental Health, CDC. The chemicals were chosen based on potential for human exposure, known or potential health effects from exposure, and technical feasibility of measurement. To be reported, results for these chemicals must pass DLS quality control and quality assurance criteria for accuracy, precision, analytical sensitivity and analytical specificity.

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Tobacco Smoke					
Cotinine	serum	•	•	•	•
4-(Methylnitrosamino)-1-(3-pyridyl)-1-Butanol (NNAL)	urine			•	•
Metals					
Lead	whole blood	•	•	•	•
Lead	urine	•	•	•	•
Cadmium	whole blood	•	•	•	•
Cadmium	urine	•	•	•	•
Mercury (total)	whole blood	•	•	•	•
Mercury (total)	urine	•	•	•	•
Inorganic Mercury	whole blood	•	•	•	•
Methyl Mercury	whole blood				•
Ethyl Mercury	whole blood				•
Arsenic (total)	urine	•	•	•	•
Arsenous (III) acid	urine	•	•	•	•
Arsenic (V) acid	urine	•	•	•	•
Monomethylarsonic acid	urine	•	•	•	•
Dimethylarsinic acid	urine	•	•	•	•
Arsenobetaine	urine	•	•	•	•
Arsenocholine	urine	•	•	•	•
Trimethylarsine oxide	urine	•	•	•	•
Antimony	urine	•	•	•	•
Barium	urine	•	•	•	•
Beryllium	urine	•	•	•	•
Cesium	urine	•	•	•	•
Cobalt	urine	•	•	•	•
Molybdenum	urine	•	•	•	•
Platinum	urine	•	•	•	•
Thallium	urine	•	•	•	•
Tungsten	urine	•	•	•	•
Uranium	urine	•	•	•	•
Phytoestrogens					
Daidzein	urine	•	•	•	•
Enterodiol	urine	•	•	•	•
Enterolactone	urine	•	•	•	•
Equol	urine	•	•	•	•
Genistein	urine	•	•	•	•
O-Desmethylangolensin	urine	•	•	•	•
Phthalates					
Mono-methyl phthalate	urine	•	•	•	
Mono-ethyl phthalate	urine	•	•	•	•
Mono-n-butyl phthalate	urine	•	•	•	•
Mono-iso-butyl phthalate	urine	•	•	•	•
Mono-benzyl phthalate	urine	•	•	•	•
Mono-cyclohexyl phthalate	urine	•	•	•	
Mono-2-ethylhexyl phthalate	urine	•	•	•	•
Mono-(2-ethyl-5-oxohexyl) phthalate	urine	•	•	•	•
Mono-(2-ethyl-5-hydroxyhexyl) phthalate	urine	•	•	•	•
Mono-(3-carboxypropyl) phthalate	urine	•	•	•	•
Mono-n-octyl phthalate	urine	•	•	•	
Mono-isononyl phthalate	urine	•	•	•	
Mono-(2-ethyl-5-carboxypentyl) phthalate	urine	•	•	•	•
Mono-(2,6-dimethyl-6-carboxyhexyl) phthalate	urine			•	•
Mono-(2,7-dimethyl-7-carboxyheptyl) phthalate	urine			•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Polycyclic Aromatic Hydrocarbons					
2-Hydroxyfluorene	urine	•	•	•	•
3-Hydroxyfluorene	urine	•	•	•	•
9-Hydroxyfluorene	urine	•	•	•	•
1-Hydroxyphenanthrene	urine	•	•	•	•
2-Hydroxyphenanthrene	urine	•	•	•	•
3-Hydroxyphenanthrene	urine	•	•	•	•
4-Hydroxyphenanthrene	urine	•	•	•	•
1-Hydroxypyrene	urine	•	•	•	•
1-Hydroxynapthalene (1-Naphthol)	urine	•	•	•	•
2-Hydroxynapthalene (2-Naphthol)	urine	•	•	•	•
PAH Hemoglobin Adducts					
(+/-)-Benzo[a]pyrene-r-7,t-8,t-9,c-10-tetrol	packed cells				•
(+/-)-Benzo[a]pyrene-r-7,t-8,t-9,t-10-tetrol	packed cells				•
(+/-)-Benzo[a]pyrene-r-7,t-8,c-9,t-10-tetrol	packed cells				•
(+/-)-Benzo[a]pyrene-r-7,t-8,c-9,c-10-tetrol	packed cells				•
Methylated Naphthols					
4-Methyl-2-Naphthol, 7-Methyl-2-Naphthol, and 6-Methyl-2-Naphthol	urine				•
7-Methyl-1-Naphthol, 8-Methyl-2-Naphthol, and 3-Methyl-1-Naphthol	urine				•
1-Methyl-2-Naphthol and 8-Methyl-1-Naphthol	urine				•
3-Methyl-2-Naphthol and 6-Methyl-1-Naphthol	urine				•
4-Methyl-1-Naphthol	urine				•
2-Methyl-1-Naphthol	urine				•
5-Methyl-1-Naphthol	urine				•
5-Methyl-2-Naphthol	urine				•
Organophosphate Insecticides: Dialkyl Phosphate Metabolites					
Dimethylphosphate	urine	•	•	•	•
Dimethylthiophosphate	urine	•	•	•	•
Dimethyldithiophosphate	urine	•	•	•	•
Diethylphosphate	urine	•	•	•	•
Diethylthiophosphate	urine	•	•	•	•
Diethyldithiophosphate	urine	•	•	•	•
Organophosphate Insecticides: Specific Pesticides and Metabolites					
Malathion dicarboxylic acid	urine	•	•	•	•
Chlorpyrifos	plasma			•	•
3,5,6-Trichloro-2-pyridinol	urine	•	•	•	•
Diazinon	plasma			•	•
2-Isopropyl-4-methyl-6-hydroxypyrimidine	urine	•	•	•	•
Methyl parathion	plasma			•	•
Parathion	plasma			•	•
para- Nitrophenol	urine	•	•	•	•
Dimethoate	urine	•	•	•	•
O- methoate	urine	•	•	•	•
2-(diethylamino)-6-methylpyrimidin-4-ol/one	urine	•	•	•	•
3-Chloro-7-hydroxy-4-methyl-2H-chromen-2-one/ol	urine	•	•	•	•
5-Chloro-1,2-dihydro-1-isopropyl-[3H]-1,2,4-triazol-3-one	urine	•	•	•	•
Dichlorovos	plasma			•	•
Fonophos	plasma			•	•
Phorate	plasma			•	•
Terbufos	plasma			•	•
Acephate	urine	•	•	•	•
Methamidaphos	urine	•	•	•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Pyrethroid Pesticides					
trans -Permethrin	plasma			•	•
cis -Permethrin	plasma			•	•
cis -3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid	urine	•	•	•	•
trans -3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid	urine	•	•	•	•
3-Phenoxybenzoic acid	urine	•	•	•	•
4-Fluoro-3-phenoxybenzoic acid	urine	•	•	•	•
cis/trans -Dimethylvinylcyclopropane carboxylic diacid	urine	•	•	•	•
cis -3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropane carboxylic acid	urine	•	•	•	•
Cyfluthrin	plasma			•	•
Cyhalothrin	plasma			•	•
Cypermethrin	plasma			•	•
Deltamethrin	plasma			•	•
Resmethrin	plasma			•	•
Tetramethrin	plasma			•	•
Organochlorine Pesticides					
Hexachlorobenzene	serum	•	•	•	•
beta -Hexachlorocyclohexane	serum	•	•	•	•
gamma -Hexachlorocyclohexane	serum	•	•	•	•
p,p'- DDT	serum	•	•	•	•
p,p' -DDE	serum	•	•	•	•
o,p' -DDT	serum	•			
Oxychlordane	serum	•	•	•	•
trans -Nonachlor	serum	•	•	•	•
Heptachlor Epoxide	serum	•			
Mirex	serum	•	•	•	•
Aldrin	serum	•			
Dieldrin	serum	•			
Endrin	serum	•			
alpha-Hexachlorocyclohexane (HCCH)	serum		•	•	•
cis -Chlordane (or alpha)	serum		•	•	•
trans -Chlordane (or gamma)	serum		•	•	•
cis -Nonachlor	serum		•	•	•
o,p '-DDE	serum		•	•	•
Octachlorosytrene	serum		•	•	•
Pentachloroanisole	serum		•	•	•
Monohydroxy methoxychlor	urine	•	•	•	•
Dihydroxy methoxychlor	urine	•	•	•	•
Endosulfan-ether	urine	•	•	•	•
Endosulfan-lactone	urine	•	•	•	•
Endosulfan-sulfate	urine	•	•	•	•
Other Pesticides					
Propoxur	plasma			•	•
2-Isopropoxyphenol	urine	•	•	•	•
Carbofuranphenol	urine	•	•	•	•
N,N-diethyl-3-methylbenzamide (DEET)	plasma	•	•	•	•
N,N-diethyl-3-methylbenzamide (DEET)	urine	•	•	•	•
3-(diethylcarbamoyl) benzoic acid (DEET acid)	urine		•	•	•
N-ethyl-3-methylbenzamide (Desethyl DEET)	urine		•	•	•
N,N-diethyl-3-hydroxymethylbenzamide (Desethyl hydroxy DEET)	urine		•	•	•
2,5-Dichlorophenol	urine	•	•	•	•
Bendiocarb	plasma			•	•
Piperonyl butoxide	plasma			•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Fungicides					
ortho -Phenylphenol	urine	•	•	•	
Chlorothalonil	serum	•	•	•	•
Metalaxyl	serum	•	•	•	•
Dichloran	serum	•	•	•	•
Ethylenethio urea (ETU)	urine	•	•	•	•
Propylenethio urea (PTU)	urine	•	•	•	•
Phthalimide	serum	•	•	•	•
Tetrahydrophthalimide	serum	•	•	•	•
Herbicides: Substituted Ureas					
Diuron	urine	•	•	•	•
Linuron	urine	•	•	•	•
Dimethoxy pyrimidine	urine	•	•	•	•
Dimethyl pyrimidine	urine	•	•	•	•
Dichlorophenyl methyl urea	urine	•	•	•	•
Dichlorophenyl urea	urine	•	•	•	•
Methyl methoxytriazine	urine	•	•	•	•
Bensulfuron-methyl	urine	•	•	•	•
Foramsulfuron	urine	•	•	•	•
Halosulfuron	urine	•	•	•	•
Nicosulfuron	urine	•	•	•	•
Primisulfuron-methyl	urine	•	•	•	•
Rimsulfuron	urine	•	•	•	•
Sulfometuron-methyl	urine	•	•	•	•
Sulfosulfuron	urine	•	•	•	•
Chlorsulfuron	urine	•	•	•	•
Oxasulfuron	urine	•	•	•	•
Ethametsulfuron-methyl	urine	•	•	•	•
Mesosulfuron-methyl	urine	•	•	•	•
Metsulfuron-methyl	urine	•	•	•	•
Prosulfuron	urine	•	•	•	•
Thifensulfuron-methyl	urine	•	•	•	•
Triasulfuron	urine	•	•	•	•
Triflusulfuron-methyl	urine	•	•	•	•
Other Herbicides					
2,4,5-Trichlorophenoxyacetic acid	urine	•	•	•	•
2,4-Dichlorophenoxyacetic acid	urine	•	•	•	•
2,4-Dichlorophenol	urine	•	•	•	•
Acetochlor	serum	•	•	•	•
Acetochlor mercapturate	urine	•	•	•	•
Alachlor	serum	•	•	•	•
Alachlor mercapturate	urine	•	•	•	•
Atrazine	serum	•	•	•	•
Atrazine	urine	•	•	•	•
Atrazine mercapturate	urine	•	•	•	•
Diaminochlorotriazine	urine	•	•	•	•
Desethylatrazine	urine	•	•	•	•
Desethylatrazine mercapturate	urine	•	•	•	•
Desisopropylatrazine	urine	•	•	•	•
Hydroxyatrazine	urine		•	•	•
Metolachlor	serum	•	•	•	•
Metolachlor mercapturate	urine	•	•	•	•
Glyphosate	urine		•	•	•
Dacthal	serum	•	•	•	•
Trifluralin	serum	•	•	•	•
Aminomethyl phosphonic acid	urine		•	•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Halogenated Phenolic Compounds					
2,4,5-Trichlorophenol	urine	•	•	•	
2,4,6-Trichlorophenol	urine	•	•	•	
Pentachlorophenol	serum		•	•	•
Pentachlorophenol	urine	•	•	•	•
5-Chloro-2-(2,4-dichlorophenoxy)-phenol (Triclosan)	serum		•	•	•
Pentabromphenol	serum		•	•	•
Perfluorinated Compounds					
Perfluorooctanoic acid	serum	•	•	•	•
Perfluorooctane sulfonic acid	serum	•	•	•	•
Perfluorohexane sulfonic acid	serum	•	•	•	•
2-(N-Ethyl- Perfluorooctane sulfonamido) acetic acid	serum	•	•	•	
2-(N-Methyl-perfluorooctane sulfonamido) acetic acid	serum	•	•	•	•
Pefluorodecanoic acid	serum	•	•	•	•
Perfluorobutane sulfonic acid	serum	•	•	•	
Perfluoroheptanoic acid	serum	•	•	•	
Perfluorononanoic acid	serum	•	•	•	•
Perfluorooctane sulfonamide	serum	•	•	•	
Perfluoroundecanoic acid	serum	•	•	•	
Perflurododecanoic acid	serum	•	•	•	
Environmental Phenols					
Bisphenol A	urine	•	•	•	•
2-Hydroxy-4-methoxybenzophenone (Benzophenone-3)	urine	•	•	•	•
4-*tert*-Octyl phenol	urine	•	•	•	
2,4,4'-Trichloro-2'-hydroxyphenyl ether (Triclosan)	urine	•	•	•	•
Methyl paraben	urine			•	•
Ethyl paraben	urine			•	•
Propyl paraben	urine			•	•
Butyl paraben	urine			•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Polychlorinated Dibenzo-*p*-dioxins and Dibenzofurans					
1,2,3,4,6,7,8,9-Octachlorodibenzo-*p*-dioxin (OCDD)	serum	•	pooled samples	•	pooled samples
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin (HpCDD)	serum	•	pooled samples	•	pooled samples
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	serum	•	pooled samples	•	pooled samples
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin (HxCDD)	serum	•	pooled samples	•	pooled samples
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin (HxCDD)	serum	•	pooled samples	•	pooled samples
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin (PeCDD)	serum	•	pooled samples	•	pooled samples
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD)	serum	•	pooled samples	•	pooled samples
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	serum	•	pooled samples	•	pooled samples
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	serum	•	pooled samples	•	pooled samples
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	serum	•	pooled samples	•	pooled samples
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	serum	•	pooled samples	•	pooled samples
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	serum	•	pooled samples	•	pooled samples
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	serum	•	pooled samples	•	pooled samples
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	serum	•	pooled samples	•	pooled samples
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	serum	•	pooled samples	•	pooled samples
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	serum	•	pooled samples	•	pooled samples
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	serum	•	pooled samples	•	pooled samples

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Polybrominated Dibenzo-*p*-dioxins and Dibenzofurans					
2,3,7,8-Tetrabromorodienzo-*p*-dioxin (TBDD)	serum		pooled samples	•	pooled samples
1,2,3,7,8-Pentabromodibenzo-*p*-dioxin (PeBDD)	serum		pooled samples	•	pooled samples
1,2,3,4,7,8-Hexabromorodibenzo-*p*-dioxin (HxBDD)	serum		pooled samples	•	pooled samples
1,2,3,6,7,8-Hexabromodibenzo-*p*-dioxin (HxBDD)	serum		pooled samples	•	pooled samples
1,2,3,7,8,9-Hexabromodibenzo-*p*-dioxin (HxBDD)	serum		pooled samples	•	pooled samples
1,2,3,4,6,7,8-Heptabromoodibenzo-*p*-dioxin (HpBDD)	serum		pooled samples		pooled samples
1,2,3,4,6,7,8,9-Octabromodibenzo-*p*-dioxin (OBDD)	serum		pooled samples	•	pooled samples
2,3,7,8,-Tetrabromodibenzofuran (TBDF)	serum		pooled samples	•	pooled samples
1,2,3,7,8-Pentabromodibenzofuran (PeBDF)	serum		pooled samples	•	pooled samples
2,3,4,7,8-Pentabromodibenzofuran (PeBDF)	serum		pooled samples	•	pooled samples
1,2,3,4,7,8-Hexabromodibenzofuran (HxBDF)	serum		pooled samples	•	pooled samples
1,2,3,4,6,7,8-Heptabromodibenzofuran (HpBDF)	serum		pooled samples	•	pooled samples
1,2,3,4,6,7,8,9-Octabromodibenzofuran (OBDF)	serum		pooled samples	•	pooled samples
Dioxin-like Polychlorinated Biphenyls - cPCBs					
3,3',4,4'-Tetrachlorobiphenyl (PCB 77)	serum		pooled samples	•	pooled samples
3,4,4',5-Tetrachlorobiphenyl (PCB 81)	serum	•	pooled samples	•	pooled samples
3,3',4,4',5-Pentachlorobiphenyl (PCB 126)	serum	•	pooled samples	•	pooled samples
3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)	serum	•	pooled samples	•	pooled samples
Dioxin-like Polychlorinated Biphenyls - mPCBs					
2,4,4'-Trichlorobiphenyl (PCB 28)	serum	•	•	•	•
2,3',4,4'-Tetrachlorobiphenyl (PCB 66)	serum	•	•	•	•
2,4,4',5-Tetrachlorobiphenyl (PCB 74)	serum	•	•	•	•
2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)	serum	•	•	•	•
2,3,3',4,4'-Pentachlorobiphenyl (PCB 114)	serum		•	•	•
2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	serum	•	•	•	•
2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	serum		•	•	•
2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)	serum	•	•	•	•
2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)	serum	•	•	•	•
2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)	serum	•	•	•	•
2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)	serum	•	•	•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Non-dioxin-like Polychlorinated Biphenyls					
2,2'3,5'-Tetrachloro biphenyl (PCB 44)	serum	•	•	•	•
2,2',4,5'-Tetrachloro biphenyl (PCB 49)	serum	•	•	•	•
2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	serum	•	•	•	•
2,2',3,4,5'-Pentachlorobiphenyl (PCB 87)	serum	•	•	•	•
2,2',4,4',5-Pentachlorobiphenyl (PCB 99)	serum	•	•	•	•
2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)	serum	•	•	•	•
2,3,3',4',6-Pentachlorobiphenyl (PCB 110)	serum	•	•	•	•
2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)	serum	•	•	•	•
2,2',3,4,4',5' and 2,3,3',4,4',6-Hexachlorobiphenyl (PCB 138 & 158)	serum	•	•	•	•
2,2',3,4',5,5'-Hexachlorobiphenyl (PCB 146)	serum	•	•	•	•
2,2',3,4',5',6-Hexachlorobiphenyl (PCB 149)	serum	•	•	•	•
2,2',3,5,5',6-Hexachlorobiphenyl (PCB 151)	serum	•	•	•	•
2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)	serum	•	•	•	•
2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)	serum	•	•	•	•
2,2',3,3',4,5,5'-Heptachlorobiphenyl (PCB 172)	serum	•	•	•	•
2,2',3,3',4,5',6'-Heptachlorobiphenyl (PCB 177)	serum	•	•	•	•
2,2',3,3',5,5',6-Heptachlorobiphenyl (PCB 178)	serum	•	•	•	•
2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)	serum	•	•	•	•
2,2',3,4,4',5',6-Heptachlorobiphenyl (PCB 183)	serum	•	•	•	•
2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB 187)	serum	•	•	•	•
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (PCB 194)	serum	•	•	•	•
2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 195)	serum	•	•	•	•
2,2',3,3',4,4',5,6' and 2,2',3,4,4',5,5',6-Octachlorobiphenyl (PCB 196 & 203)	serum	•	•	•	•
2,2',3,3',4,5,5',6-Octachlorobiphenyl (PCB 199) (change in nomenclature; previously referred to as PCB 201)	serum	•	•	•	•
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB 206)	serum	•	•	•	•
2,2',3,3',4,4',5,5',6,6'-Decachloro biphenyl (PCB 209)	serum	•	•	•	•
Hydroxylated Polychlorinated Biphenyls					
2,3,3',4',5-pentachloro-4-biphenylol (4-HO-CB107)	serum		•	•	•
2,2',3,4',5,5'-hexachloro-4-biphenylol (4-HO-CB146)	serum		•	•	•
2,2',3,4',5,5,6'-heptachloro-4-biphenylol (4-HO-CB187)	serum		•	•	•
Polybrominated Diphenyl Ethers					
2,2',4'-Tribromodiphenyl ether (BDE 17)	serum	•	•	•	•
2,4,4'-Tribromodiphenyl ether (BDE 28)	serum	•	•	•	•
2,2',4,4'-Tetrabromodiphenyl ether (BDE 47)	serum	•	•	•	•
2,3',4,4'-Tetrabromodiphenyl ether (BDE 66)	serum	•	•	•	•
2,2',3,4,4'-Pentabromodiphenyl ether (BDE 85)	serum	•	•	•	•
2,2',4,4',5-Pentabromodiphenyl ether (BDE 99)	serum	•	•	•	•
2,2',4,4',6-Pentabromodiphenyl ether (BDE 100)	serum	•	•	•	•
2,2',4,4',5,5'-Hexabromobiphenyl (BB 153)	serum	•	•	•	•
2,2',4,4',5,6'-Hexabromodiphenyl ether (BDE 154)	serum	•	•	•	•
2,2',4,4',5,5'-Hexabromodiphenyl ether (BDE 153)	serum	•	•	•	•
2,2',3,4,4',5',6-Heptabromodiphenyl ether (BDE 183)	serum	•	•	•	•
2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether (BDE 209)	serum		•	•	•
Hexabromobenzene (HBB)	serum		•	•	•
Polychlorinated Naphthalenes					
1,2,3,4-Tetrachlorinated naphthalene (PCN 27)	serum			•	•
1,2,3,5,7- and 1,2,4,6,7-Pentachlorinated naphthalene (PNC 52 & 60)	serum			•	•
1,2,3,4,5,7- and 1,2,3,5,6,8-Hexachlorinated naphthalene (PNC 64 & 68)	serum			•	•
1,2,3,4,6,7- and 1,2,3,5,6,7-Hexachlorinated naphthalene (PNC 66 & 67)	serum			•	•
1,2,3,5,7,8-Hexachlorinated naphthalene (PCN 69)	serum			•	•
1,2,3,4,5,6,7-Heptachlorinated naphthalene (PCN 73)	serum			•	•
Toxaphenes					
Parlar 26 2-Endo,3-exo,5-endo,6-exo,8b,8c,10a,10c-octachlorobornane	serum		•	•	•
Parlar 50 2-Endo,3-exo,5-endo,6-exo,8b,8c,9c,10a,10c-nonachlorobornane	serum		•	•	•
Parlar 62 2,2,5,5,8c,9b,9c,10a,10b-nonachlorobornane	serum		•	•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Volatile Organic Compounds (VOCs)					
1,1,1-Trichloroethane	whole blood	•	•	•	•
1,1,2,2-Tetrachloroethane	whole blood	•	•	•	•
1,1,2-Trichloroethane	whole blood	•	•	•	•
1,1-Dichloroethane	whole blood	•	•	•	•
1,1-Dichloroethene	whole blood	•	•	•	•
1,2-dibromo-3-chloropropane	whole blood	•	•	•	•
1,2-Dichlorobenzene	whole blood	•	•	•	•
1,2-Dichloroethane	whole blood	•	•	•	•
1,2-Dichloropropane	whole blood	•	•	•	•
1,3-Dichlorobenzene	whole blood	•	•	•	•
1,4-Dichlorobenzene	whole blood	•	•	•	•
2,5-Dimethylfuran	whole blood	•	•	•	•
Acrylonitrile	whole blood			•	•
Benzene	whole blood	•	•	•	•
Bromodichloromethane	whole blood	•	•	•	•
Bromodichloromethane	water	•	•	•	•
Bromoform	whole blood	•	•	•	•
Bromoform	water	•	•	•	•
Carbon Tetrachloride	whole blood	•	•	•	•
Chlorobenzene	whole blood	•	•	•	•
Chloroform	whole blood	•	•	•	•
Chloroform	water	•	•	•	•
cis -1,2-Dichloroethene	whole blood	•	•	•	•
Dibromochloromethane	whole blood	•	•	•	•
Dibromochloromethane	water	•	•	•	•
Dibromomethane	whole blood	•	•	•	•
Ethylbenzene	whole blood	•	•	•	•
Furan	whole blood			•	•
Hexachloroethane	whole blood	•	•	•	•
m-/p-Xylene	whole blood	•	•	•	•
Methylene Chloride	whole blood	•	•	•	•
Methyl-tert-Butyl Ether (MTBE)	whole blood	•	•	•	•
Methyl-tert-Butyl Ether (MTBE)	water	•	•	•	•
Nitrobenzene	whole blood	•	•	•	•
o -Xylene	whole blood	•	•	•	•
Styrene	whole blood	•	•	•	•
Tetrachloroethene	whole blood	•	•	•	•
Toluene	whole blood	•	•	•	•
trans -1,2-Dichloroethene	whole blood	•	•	•	•
Trichloroethene	whole blood	•	•	•	•
1,4-Dioxane	whole blood			•	•
1,2-Dibromoethane	whole blood			•	•
n-Hexane	whole blood			•	•
Nitromethane	whole blood			•	•
1,1,1,2-Tetrachloroethane	whole blood			•	•
Cumene	whole blood			•	•
1,2,3-Trichloropropane	whole blood			•	•
***trans* Fatty Acids**					
trans -9-Hexadecenoic acid	plasma		•	•	•
trans -9-Octadecenoic acid	plasma		•	•	•
trans,trans -9,12-Octadecadienoic acid	plasma		•	•	•
trans-6- Octadecanoic acid	plasma			•	•
trans-11- Octadecanoic acid	plasma			•	•

Chemical / Metabolite Name	Matrix	03-04	05-06	07-08	09-10
Other					
Perchlorate	urine	●	●	●	●
Perchlorate	water		●	●	●
Thiocyanate	urine		●	●	●
Nitrate	urine		●	●	●
Nitrate	water		●	●	●
Iodide	water	●	●	●	●
Ethylene Oxide	packed cells				●
Acrylamide	packed cells	●	●	●	●
Glycidamide	packed cells	●	●	●	●