



INSTRUCTION MANUAL

Data Collection

PART

15<sup>a</sup>

96

*Rowland*

# HANES

Examination Staff Procedures Manual  
for the Health and Nutrition  
Examination Survey, 1971-1973



U.S. DEPARTMENT OF  
HEALTH, EDUCATION, AND WELFARE  
Public Health Service

Health Services and Mental Health Administration



INSTRUCTION MANUAL  
Data Preparation

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# **HANES**

## **Examination Staff Procedures Manual for the Health and Nutrition Examination Survey, 1971-1973**



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HEALTH, EDUCATION, AND WELFARE**  
**Public Health Service**  
**HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION**

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# PART I. INTRODUCTION

## CHAPTER 1

### THE HEALTH AND NUTRITION EXAMINATION SURVEY

#### General

In 1956 the Congress authorized the U.S. Public Health Service to conduct a continuing National Health Survey to obtain information on the health of the American people. Since then, findings from the survey have greatly expanded knowledge of health in the United States. From the survey have come estimates of the number of people with heart disease and diabetes, for example, and understanding of how the prevalence of these conditions varies among people of different ages and sexes. The Federal Government, as well as many public and private agencies, relies on the information collected in planning action to improve health. The findings are also valuable to medical research scientists, educators, physicians, and dentists.

The National Health Survey obtains information in several ways. People are asked questions about themselves and their health. Records of hospitals and nursing homes where people receive health care are studied. Actual health examinations are administered to get information which can only be obtained by this means. This latter method is being employed in the current Health and Nutrition Examination Survey (HANES), a major part of the National Health Survey. Over the past 10 years several thousand American children, adolescents, and adults have taken part voluntarily in three different surveys involving special health examinations

In HANES data are collected by actual examinations and tests of the individuals in the sample. Such examinations and tests can yield morbidity information that is unobtainable through other programs of the National Health Survey. They can provide information about diagnosed conditions including those which persons may fail to report or may be incapable of reporting in a survey based upon individual interviews. They can also reveal previously undiagnosed, unattended, and nonmanifested chronic diseases. In addition to serving this primary purpose of determining prevalence of specified diseases, the examinations are intended to obtain baseline data on certain nutritional, physical, psychological, and physiological measurements. Such measurement data on a defined population are needed for understanding departures from the norms, as well as for assisting in planning certain specific programs dependent upon human engineering information.

The individuals entering these examinations are selected through the use of a nationwide probability sample of the civilian, noninstitutionalized population of the United States. The use of such a procedure makes it possible to obtain the desired statistics efficiently and economically and in such a manner that the statistical reliability of results is determinable.

## Purpose and Plan

The central purposes of the current program are to measure the nutritional status of the United States population between the ages of 1 and 74 and to obtain further information on the health status and medical care needs of those between 25 and 74. During a 2½-year period some 30,000 persons will be selected to receive a nutrition examination. Of these, about 6,000 will also be selected to receive a more detailed examination concentrating on certain chronic diseases or conditions which are more prevalent among people between the ages of 25 and 74. These people will also be questioned about the amounts and kinds of medical care they have received.

All information collected in the survey is held in strictest confidence. Findings are summarized and issued as statistical reports reflecting the health status of the American people as a whole. Information is never released in any form that could be used to identify any individual participant.

## Description of the Examination

Examinations are given in three mobile Health Examination Centers, each of which consists of three specially built and equipped trailers. The examination teams include physicians, dentists, nurses, dietary interviewers, and medical and laboratory technicians. There is no cost to participants, and transportation to and from the examination is provided.

Questionnaires are used to obtain basic demographic and socioeconomic characteristics, medical history data, and information on dietary intake for all persons in the sample. Each person is examined by a physician for certain conditions that affect or are affected by nutrition, as well as by an ophthalmologist, dermatologist, and dentist. In addition, a series of body measurements is taken; a sample of blood is analyzed; and a series of biochemical tests related to nutritional status is performed, primarily at the Nutrition Laboratory of the Center for Disease Control.

For the subset of the sample receiving the detailed examination data will also be gathered on current and unmet medical care needs as perceived by the sample persons, and this information will be related to their health needs as professionally and scientifically determined by the survey's examinations and tests. In addition, the examination for this subset of sample persons includes a more detailed examination by the physician; an electrocardiogram; a hearing test; X-rays of the chest, hips, and knees; measurement of active and passive movement of the joints; a tuberculin test; and a measurement of breathing capacity.

A report of findings for each examinee receiving the detailed examination is sent to his physician or clinic. This report includes any new significant medical, dermatological, and ophthalmological findings; it also includes height, weight, visual acuity, hearing levels, urinalysis and hematological results, tuberculin skin test results, chest X-rays, and an electrocardiogram tracing.

While reports to physicians of nutrition examinees are not ordinarily sent, if anything abnormal is found during the exam a report is sent which includes new significant medical, dermatological, and ophthalmological findings; as well as height, weight, visual acuity, and urinalysis and hematological results.

Results of the dental exam are sent to the dentists of all examinees.



## CHAPTER 2

### QUALITY CONTROL IN DATA COLLECTION

#### General

There are two sources of error that may enter into a sample survey—sampling error and nonsampling error. The sampling error—error due to making measurements on a sample rather than on the entire population—can be quantified and is the concern of all statisticians in sample survey design.

The less heralded but equally important nonsampling error is often neglected in sampling texts but is infallibly present in all data gathering ventures. It is on the control of nonsampling error that quality control centers. Much time and effort in the Health and Nutrition Examination Survey is devoted to reducing nonsampling error and to collecting data that are of a high degree of quality.

One type of nonsampling error which occurs in voluntary surveys is the bias introduced by nonresponse. As evidenced by the high proportion of sample persons examined in previous cycles, this problem has not been a great one. The high response rates obtained have resulted from advance planning and publicity, from much diligent work by the interview personnel, and by the proper handling of examinees by the entire staff. Many factors in the design of HANES may make it difficult to obtain the high response rates of previous cycles. However, we hope that with everyone's concerted effort we will reach a satisfactory level.

More closely related to the purposes of this manual are the nonsampling errors which may be introduced by variabilities and biases associated with the examiners, and the mechanical devices used. Many machines, some simple and some complex, are used in the HANES. With proper calibration and maintenance the errors associated with these devices can be controlled. Instructions for the calibration and maintenance of equipment are found in this manual. Bearing in mind the potential uses of the data, we adopt procedures that will reduce examiner and subject errors; but in general, we cannot design procedures that will eliminate errors. However, certain types of examiner and subject errors can be fairly readily identified and controlled.

Several measures are taken to assure completeness and consistency in the recording process. All questionnaires are reviewed for omissions and inconsistencies. If errors are noted, correct information is obtained by phone or from the examinee when he comes in for the examination. Errors in recording some measurements are reduced by having a second person act as a recorder. In addition, all data gathered in the examining center are reviewed by a designated exam staff member before the examinees leave. Records of unusual occurrences which may affect the validity of the data are also maintained.

Although emphasis is placed on doing examinations in a uniform and standard manner in the staff training (and retraining) periods, drift in technique is apt to occur in lengthy surveys such as HANES. It is intended that this manual be used as a reference to help standardize procedures and reduce errors throughout the entire HANES.

## Recording

Just as uniformity and standardization are important in performing the procedures of the health examination, these same two characteristics are vital to recording the observations or measurements which are the result of the procedures. Accuracy and precision again are important, as well as an additional characteristic—legibility. A scrawled entry which cannot be read is no entry at all—it is lost data.

Completeness in recording is something that is often overlooked. We do not mean here, long, drawn-out wordy entries. Rather, we do mean being sure not to omit entries—of course, the entries should be accurate, precise, and legible.

We will have unavoidable losses of data—no X-rays on some, inability to obtain optimal performance of a procedure, and so forth. The examining staff are expected to use discretion regarding these unavoidable losses—to stop procedures occasionally as necessary when it is apparent that examinees cannot cooperate despite your best efforts. It is the avoidable loss of data that is the responsibility of each staff member to prevent. When no entry is possible, indicate this and the reason. Most sections of the record now make provision for this and should be used when necessary. Care should be taken not to write in any of the spaces set aside for coding.

To summarize:

1. A good record is the other half of a good observation; neither is adequate without the other.
2. Recording requires UNIFORMITY, ACCURACY, PRECISION, LEGIBILITY, and COMPLETENESS.
3. Each staff member should review each case record section as soon as he has finished making entries in it to be sure there are no avoidable omissions or other errors or shortcomings.

## Replicate Data

Despite precautions there are biases and variable measurement errors that cannot be or are not judged important enough to be eliminated. Another objective of the quality control program, therefore, is the determination of the extent of these errors. In the HANES the primary means for evaluating both of these types of errors is by replicate measurements. Replicate data are obtained basically in two ways: by reevaluating or rereading a hard document or by reproducing an actual measure-

ment, either by the usual procedure or by a standard procedure. Although hard documents such as the weight and height measurements are reevaluated, the replicate program is primarily concerned with reproducing actual measurements.

During the actual operation of the survey, the primary use of replicate data is in indicating areas where retraining or reevaluation of procedures is needed. When the reports of findings of the survey are published, data from the replicates will be used to apprise the reader of the extent to which the data may be affected by measurement error and to call his attention to this problem.

Replicate data are gathered in many specific areas of the examination with varying degrees of frequency. For example, replicate measurements are made as frequently as on every examinee for measurements such as spirometry and hematocrit. In the dental and ophthalmological examinations advisors systematically replicate the field examiners on a subsample of examinees for the purpose of surveillance and on-the-spot retraining. The dental advisors also periodically replicate one another. Although replicates are performed for a different purpose the data are preserved and in previous DHES surveys have proved useful for indicating the extent of error in final evaluations. Additional blood is drawn from a systematic subsample of examinees. The blood sample is split and sample numbers assigned so that the paired samples cannot be identified as originating from single examinees by the laboratory doing the determinations. Evaluation performed upon receipt of results will also be used in the final evaluation of measurement process error. In addition, each laboratory has its own quality control procedures which include the use of standards and repeated determinations.

CHAPTER 3  
RESPONSIBILITIES OF EXAMINATION STAFF MEMBERS

Medical Policy Regarding the Examination

We are in the business of collecting data for statistical analyses. We are not set up to treat or manage a particular medical problem, nor are we meant to do any such treatment. Indeed, in most instances the examining physician will not be licensed within the State in which the examinations are being conducted. Because of these as well as other reasons certain policies must be followed.

An individual examinee should not be given any information on the findings of the examination except where medical advice of a very general, noncontroversial nature would be beneficial to the examinee. Thus it is quite appropriate, say, for the dentist to provide advice on dental care or the dietary interviewer to provide information on the value of eating proper foods. However, a single examination often does not allow an adequate interpretation of findings nor the best specific advice to give to an examinee. Only the examinee's personal physician or clinic physician, who has the individual's long-term records available and who is primarily involved with the long-term care and followup of the examinee, should interpret the findings for the individual and decide what to tell the person. For this reason reports of findings are sent to the physician or clinic the examinee indicates. For each person undergoing the detailed examination the report summary is sent to the physician along with a CDC laboratory report, EKG, chest X-ray, TB skin test results, and audiograms. The examinee is encouraged to contact his physician or clinic for results. For the nutrition examinee a report summary is sent for any abnormal findings or lab values.

Whenever a condition is found (such as abdominal mass or otitis media) which, in the opinion of the examining physician requires early medical care, the examining physician should contact the personal physician or clinic named on the consent form the examinee has given, indicating the presence of the condition after consulting with other staff members to determine whether other findings should also be reported.

When in such a circumstance the examinee has **not** indicated a physician, appropriate referral should be made depending upon the locality, using the advice of local medical authorities. This may vary from referral to a medical center clinic or emergency room to referral to a private physician nearby listed on the medical society roster for such matters. The medical advisors of the survey should be informed of all physician, nurse, or clinic contacts.

In other cases when it is advisable or necessary to transfer medical findings, laboratory data, X-rays, or electrocardiograms to the examinee's physician prior to routine reporting of the results, the physician should check that a consent form

has been signed and send either a copy of the report form or an official HANES letter with the phone number and address of the examination center.

As a matter of policy, when male physicians and dermatologists are examining female examinees over age 10, either the nurse or another adult female should be present in the examining room.

#### Responsibilities - All Staff Members

Membership in the Health and Nutrition Examination Survey carries with it many responsibilities. Not the least of these is your responsibility to recognize that you are one member of a team of professional and paraprofessional persons upon whom certain demands have been placed in order to accomplish the overall task of the Health and Nutrition Examination Survey. You should be aware of and respect the job demands placed upon other staff members, should maintain an attitude of tolerance and consideration for fellow members of the team, and should willingly perform the extra tasks that may occasionally be assigned to support other staff members in the performance of their duties.

Each member has a responsibility to the Public Health Service for promoting good public relations. The Public Health Service will be judged by the actions of the staff both on and off duty. You must be discreet in speech and actions. You should refrain from any discussions about an examinee which might be overheard and from any discussions of the survey which might be overheard and unfavorably misinterpreted. You should exercise good judgment in any discussion of controversial subjects. You should be conscious of the customs of the area and should avoid any actions which might reflect unfavorably upon the Public Health Service or interfere with the work of the survey. Your personal appearance and behavior must be governed by these same considerations.

The examinee should be treated courteously as a person, not as a sample number. Exchanges of information between staff members for the better understanding of an examinee must be discreet.

Each individual staff member is the first and best guarantor of the quality of the data being collected. As such you have a responsibility for quality in every single step of the examination process. The most obvious methods of assuring quality are to perform procedures with accuracy, precision, and in a uniform manner according to instructions and to record completely, accurately, uniformly, and legibly. You are urged to suggest areas where quality control procedures need to be instituted and methods for their implementation.

All staff members except the examining physician, dermatologist, and ophthalmologist may be required to drive a government, private rental, or privately owned automobile to transport examinees and coworkers to and from the examination center or to accompany the examinees by taxicab or public transportation to and from the center. Staff members may be requested to perform tasks not directly related to their specific professional skills in order to implement the overall organization. Staff members are responsible for appropriate care and safeguarding of portable expensive equipment such as cameras, tape recorders, etc., used during the examination, including storing and locking in instances where applicable.

## 1. Coordinator

In addition to the general responsibilities of all staff members it is the responsibility of the coordinator to:

- A. Arrive for work 30 minutes before the first examinees scheduled.
- B. Coordinate the flow of examinees through the examination center according to the procedure described in this manual.
- C. Take the oral temperature of each examinee by the time he has changed, and to report any temperature over 101° F to the physician.
- D. Try to make each examinee as comfortable as possible while he is in the examination center.
- E. See that transportation is arranged for examinees who did not drive themselves to the examination center and that examinees who did drive themselves to the examination center are reimbursed for their mileage.
- F. Complete and review certain parts of the physician's "Report of Findings" (see page 3-17), and to review certain completed records (see page 3-19).
- G. Check all rooms before leaving the trailers to see that all portable expensive equipment is stored and locked, and to see that all doors are locked when she leaves.
- H. Act as a liaison between the Field Operations Manager and the examination staff.
- I. See that certain data are transmitted from the field according to the instructions in Chapter III of the HANES *Field Operations Manual*.

## 2. Dentist

In addition to the general responsibilities of all examination staff members it is the responsibility of the dentist to:

- A. Arrive for work 15 minutes before the first examinees scheduled.
- B. Complete the dental examination in all aspects, in the uniform manner described in this manual. Try to do each dental examination in about 9 minutes. The maximum time allowed for the dental exam is 15 minutes. You should complete the exam within that time; but, if that is impossible, it is more important to stay within 15 minutes than to finish the examination. If you cannot complete your exam within 15 minutes, write "max. time" as the reason for noncompletion on the control record. In trying to stay within the maximum time do not rush the exam to such an extent that you feel the quality of the data that you do get is reduced. If part of an examination is missed due to the maximum time rule, it may be possible to finish the exam later provided that the examinee has finished all his other examinations and is perfectly willing to remain longer, and that you have finished all your other examinations.

- C. Take an enamel biopsy from all persons with a permanent upper incisor tooth present with sufficient area on the labial surface, free of fillings, for the window in the plastic tape used to isolate the biopsy location.
- D. Review each record for quality and completeness remembering that this responsibility is his not the recorder's.
- E. Complete a report of dental findings for all examinees who have so requested.
- F. Serve as the observer-recorder for the technician who does the body measurements and goniometry.
- G. Give proper care and attention to the dental instruments and equipment.
- H. See that certain data are transmitted from the field according to the instructions in Chapter III of the HANES *Field Operations Manual*.

### 3. Dermatologist

In addition to the general responsibilities of all examination staff members it is the responsibility of the dermatologist to:

- A. Arrive for work 15 minutes before the first examinees scheduled.
- B. Review the appropriate sections of the previously completed medical history questionnaire referring to history of the skin and related conditions; review at the time of the examination those pertinent "positive" responses on the questionnaire in order to clarify certain points and aid in the overall assessment of the skin.
- C. Carry out a complete dermatological examination in a uniform way as outlined in this manual. Try to complete the dermatological examination in about 9 minutes. The maximum time allowed is 15 minutes. You should complete the examination within the maximum time; but, if that is impossible, it is more important to stay within 15 minutes than to finish the examination. If you cannot complete your exam within 15 minutes write "max. time" as the reason for noncompletion on the control record. The very unusual examination during which an examinee has a skin biopsy is excepted from the maximum time rule. In trying to stay within the maximum time, do not rush the exam to such an extent that you feel the quality of the data that you do get is reduced. If part of an examination is missed due to the maximum time rule, it may be possible to finish the exam later provided that the examinee has finished all his other examinations and is perfectly willing to remain longer, and that you have finished all your other examinations.
- D. Complete the appropriate section of the "Report of Findings" form (see page 3-18).
- E. Assist the nurse in the blood-drawing procedures when requested.
- F. Assist the examining physician in providing whatever emergency care is necessary, given the available resources, should the need arise.

- G. Contact an examinee's personal physician or clinic whenever a dermatological condition requiring early or immediate attention is noted during the course of the examination.
- H. Provide "late" coverage by being present within the exam center until the last examinee has completed the examination (excluding the questionnaire completion) at all morning sessions.
- I. Do the nutrition component of the physician's examination on both nutrition and detailed examinees if the physician is ill or absent from work.
- J. Be familiar with the "Medical Policy Regarding the Examination."

#### 4. Dietary Interviewers

In addition to the general responsibilities of all examination staff members it is the responsibility of the dietary interviewers to:

- A. Arrive for work 15 minutes before the first examinees scheduled.
- B. Conduct interviews with all examinees to obtain a 24-hour dietary recall and information about the frequency with which certain foods are eaten, and administer Health Care Needs and General Well-Being questionnaires to examinees receiving the detailed examination. Try to do each dietary interview in about 25 minutes and administer the General Well-Being and Health Care Needs questionnaires in about 20 minutes. The maximum times allowed for these are 30 minutes for a dietary interview and 25 minutes for GWB-HCN. (Within the GWB-HCN block, no more than half of the allotted time should be spent on whichever questionnaire is administered first). You should do an interview within the time allowed; but, if that is impossible, it is more important to stay within the maximum time than to finish the interview (or questionnaire). If you cannot complete your interview within the time allowed, write "max. time" as the reason for noncompletion on the control record. In trying to stay within the maximum time do not rush the interview to such an extent that you feel the quality of the data that you do get is reduced. If part of an interview is missed due to the maximum time rule, it may be possible to finish the interview later provided that the examinee has finished all his other examinations and is perfectly willing to remain longer, and that you have finished all your other interviews.
- C. Collect dietary data during home visits to examinees whose dietary data are not collected during their time at the examination center.
- D. Insert the appropriate codes for each food reported on the 24-hour dietary recall.
- E. Check forms prepared by herself and the other dietary interviewer for completeness and accuracy before they are sent to headquarters (see page 3-19).
- F. Keep a daily log of persons interviewed.



- G. Chaperone dermatologist's and physician's examinations, and help with arriving examinees when requested by the coordinator.
- H. See that certain data are transmitted from the field according to the instructions in Chapter III of the HANES *Field Operations Manual*.

The dietary coordinator has the following additional responsibilities:

- I. Oversee and coordinate the work of dietary interviewers, especially regarding consistency of interviewing techniques and application of food codes.
- J. Contact nutrition personnel in health, welfare, school system, and /or other agencies regarding necessary background information before examinations begin at each stand.
- K. See that an accurate daily log is kept of dietary home visits, appointments scheduled, and interviews completed.
- L. Account for all dietary records and send them to headquarters at the end of each stand.

## 5. Health Technicians

### A. Responsibilities related to examinations

In addition to the general responsibilities of all staff members it is the responsibility of the health technicians to:

- (1) Arrive for work 30 minutes before the first examinees scheduled.
- (2) Do the necessary calibrations and maintenance prior to each session as specified in this manual.
- (3) Carry out all your parts of the examination completely and in a uniform way as described in this manual. Try to do your parts of the examination in about the times recommended below. The maximum times allowed for each part are also given below. You should complete each part within the time allowed; but, if that is impossible, it is more important to stay within the maximum time than to finish the examination. If you cannot complete an exam within the time allowed, write "max. time" as the reason for noncompletion on the control record. In trying to stay within the maximum time do not rush the exam to such an extent that you feel the quality of the data that you do get is reduced. If part of an examination is missed due to the maximum time rule, it may be possible to finish the exam later provided that the examinee has finished all his other examinations and is perfectly willing to remain longer, and that you have finished all your other examinations.

	<u>Nutrition</u>		<u>Detailed</u>	
	Rec	Max	Rec	Max
Technician Block (EKG-Spiro, Lung Anal., X-ray, Audio)	--	--	65	80 (about 20 each)
Dental-Technician Block				
Dental Exam	9	15	9	15
Body Measurements	6	10	6	10
Goniometry	--	--	7	10
Hand X-ray (1-17)	3	5	--	--

Do the exams within the tech block in the following order:

- (1) EKG, (2) Spirometry, (3) Single Breath Diffusing Capacity, (4) X-rays, and (5) Audiometry.
- (4) Screen detailed examinees prior to pulmonary function testing unless the physician has already seen the examinees. All examinees who the technicians think have contraindications to testing should, prior to testing, be examined by the physician who will pass final judgment as to whether any tests should be omitted.

Since maximum expiration puts strain on many areas of the body, absolute rules would be voluminous for screening examinees prior to spirometry. Hence, first explain the strain of blowing maximally and ask "Is there any reason that you should not blow into our machine?" The answers may be as varied as "I have a cerebral aneurysm" to "Blowing brings on my seizures." Each examinee with a serious complaint should be referred to the physician prior to spirometry. Also ask each examinee specifically "Have you had heart disease, angina or chest pains, tuberculosis, surgery on your abdomen or chest in the last six weeks, or do you have a hernia or a respiratory tract infection?" Ask females "Are you pregnant?" Refer examinees with positive responses to the physician prior to pulmonary function testing with the Ohio Spirometer or Collins Analyzer.

- (5) Serve as recorders for the dentist during the dental examination.
- (6) Make a record on the unusual occurrences form of any exam not done, done on a defective machine, or done in a nonstandard way.
- (7) Inform the coordinator, FOM,, and supervisory technician of all equipment failures that prevent you from doing examinations, and see that the equipment is fixed as soon as possible.

- (8) Check all technician parts of the examination record for completeness, accuracy, and consistency; and check the X-rays for correct identification and the physician's initials and the X-ray envelopes for correct identification.
- (9) Complete and review certain parts of the physician's Report of Findings (see page 3-18).
- (10) See that certain data are transmitted from the field according to the instructions in Chapter III of the HANES *Field Operations Manual*.

#### B. Additional responsibilities of Technician A

- (1) Check the anthropometer scale and skinfold caliper daily.
- (2) Flush and calibrate the lung analyzer daily.
- (3) Do the spirometer volume mechanical calibration daily.
- (4) Replenish the necessary supplies in the body measurement and respiratory rooms daily, and close down these rooms at the end of each day.
- (5) See that the physician has seen all the EKG's before the examinees leave the examination center.
- (6) Check and file the EKG, spiro, and lung analyzer tracings.
- (7) Clean and sterilize the lung analyzer mouthpieces.
- (8) Check the EKG-Spiro data book to see that the entries are correct.
- (9) Maintain all the equipment in the body measurement and respiratory rooms.

#### C. Additional responsibilities of Technician B

- (1) Start the X-omat, check the chemical levels, and run check films daily.
- (2) Do an audiometer check daily, and calibrate the audiometer weekly.
- (3) Change the date on the X-ray marker daily.
- (4) Replenish all the necessary supplies in the X-ray and audiometry rooms daily, and close down these rooms at the end of each day.
- (5) See that the physician has seen all the chest X-rays before the examinees leave the examination center.
- (6) Check all X-rays and repeat them if necessary.
- (7) Duplicate all chest X-rays.
- (8) Label and file all X-rays.
- (9) Maintain all the equipment in the audiometry and X-ray rooms.

#### D. Technician responsibilities at the beginning of each stand

- (1) Complete the inventory of all supplies, return the original to headquarters, and note additional supplies needed.
- (2) Plug in the voltmeter to trailers 1 and 3, and check the readings.

(3) Lung Analyzer

- (a) Remove the floor plate and wall screws.
- (b) Plug in and turn on the machine.
- (c) Replace the drierite at the back of the little unit.
- (d) Fill the drum with distilled water.
- (e) Replace the arm and tubing.
- (f) Check the kymograph speed.
- (g) Attach the gas tank regulator, and secure the tank to the wall.
- (h) Post the helium content on the machine.
- (i) Untape the barometer, and put it in the centering ring.
- (j) Drop the mercury column.
- (k) Adjust the vent grid.

(4) EKG and Spirometer

- (a) Remove the metal plate.
- (b) Put on the computer tape.
- (c) Record the barometric pressure in the EKG-Spiro data book.
- (d) Insert and connect the flow-volume converter.
- (e) Check the settings and function of the calculator display meter and oscilloscope.
- (f) Adjust the oscilloscope line voltage setting. Low: 90-110V, medium: 104-126V, high: 112-136 V.
- (g) Make the necessary adjustments to the digicorder.
- (h) Do spirometry calibrations, and send the tracings to the supervisory technician.

(5) Body Measurements

- (a) Assemble the anthropometers, and check them and the calipers.
- (b) Disengage the lock on the weight scale.
- (c) Calibrate the standing height and weight scales, and send the calibrations to the Quality Control Section.

(6) Audiometer

- (a) Set up the audiometer and masking unit.
- (b) Do the calibrations and send copies to Jean Roberts and Ken Stewart.

(7) X-ray machine

- (a) Remove all bolts according to the instruction book.
- (b) Level the metal stool.
- (c) Check the MAS at all MA stations.

(8) X-omat

- (a) Fill and rinse with water of 90° F.
- (b) Replace the developer filter.
- (c) Mix the chemicals.
- (d) Check the water pressure.
- (e) Check all the settings and chemical temperatures.

E. Responsibilities at the end of each stand

(1) Complete the inventory of all supplies.

(2) Lung Analyzer

- (a) Drain and clean the drum.
- (b) Secure the CO analyzer and bell chain.
- (c) Unplug the machine.
- (d) Remove the arm and tubing.
- (e) Remove the tank regulator.
- (f) Adjust the mercury column to the top of the barometer.
- (g) Tape the barometer to the wall.
- (h) Attach the wall screws and floor plate.

(3) EKG and Spirometer

- (a) Remove the computer tape and send to the Data Control Section.
- (b) Make 2 copies of the EKG-Spiro data book and send one each to the Data Control Section and the supervisory technician.
- (c) Do spirometry calibrations and send the tracings to the supervisory technician.
- (d) Remove the flow-volume converter from the rack.
- (e) Open the spiro piston and insert the stopper.
- (f) Sterilize and wash the spiro tube.
- (g) Secure all the panels and the metal plate in front of the digicorder.

(4) Body Measurements

- (a) Calibrate the standing height and weight scales and send the calibrations to the Quality Control Section.
- (b) Engage the scale lock.
- (c) Disassemble and pack the anthropometers.
- (d) Lock the table drawer.

(5) Audiometry

- (a) Do the calibrations and send copies to Miss Roberts and Mr. Stewart.
- (b) Pack up the audiometer and masking unit and send them to Mr. Stewart.
- (c) Pack all the calibrating machines.

(6) X-ray room

- (a) Prepare the X-ray machine for transit according to the instruction book.
- (b) Lock the film bin.
- (c) Send the hand X-rays on detailed examinees to George Vose.

(7) X-omat

- (a) Drain all chemicals.
- (b) Remove the developer filter.
- (c) Rinse the unit with water of 90° F.
- (d) Clean tanks, rollers, etc.
- (e) Replace all the parts, and tape the sides and cover.
- (f) Note: Clean with systems cleaner every 4 months.

(8) Packing of records

Account for on the transmittal forms and pack up in numerical order the EKG, Spiro, and lung analyzer tracings and the chest X-rays.

6. Laboratory technicians

In addition to the general responsibilities of all examination staff members it is the responsibility of the laboratory technicians to:

- A. Arrive for work at the time the first examinees are scheduled.
- B. Perform the basic hematology, urinalysis, and sample preparation related to both nutrition and detailed examinee specimens obtained.
- C. Check out all equipment prior to the receipt of the first whole blood and urine at the beginning of each examination session.
- D. Record all values on a daily worksheet and on the individual specimen identity cards.
- E. Record all abnormalities found in the hematology (after verification by repeating the tests) on the daily worksheet.
- F. Ship all required specimens daily to CDC after verifying the packing list.

- G. Perform all required quality control procedures daily or weekly as prescribed by CDC, and to send the appropriate forms to CDC weekly.
- H. Keep up to date an inventory of equipment and supplies on hand or needed. This includes notifying the FOM of the dry ice supply daily.
- I. See that the laboratory equipment is properly maintained. If necessary call the Operations Section and the manufacturer's representative to insure proper repair of the equipment.
- J. Complete and review certain parts of the physician's "Report of Findings" (see page 3-18).
- K. See that certain data are transmitted from the field according to the instructions in Chapter III of the HANES *Field Operations Manual*.

## 7. Nurse

### A. Responsibilities related to examinations

In addition to the general responsibilities of all examination staff members it is the responsibility of the nurse to:

- (1) Arrive for work 30 minutes before the first examinees scheduled.
- (2) Draw the appropriate amount of blood from all examinees according to the instructions in this manual. The maximum time for the venipuncture is 10 minutes for everyone except small children who have the venipuncture at the end of their examination; the maximum time for these venipunctures is 15 minutes. If you don't have the required amount of blood by then quit and write "max. time" as the reason for noncompletion on the control record.
- (3) Give the tuberculin skin test to all detailed examinees according to the instructions in this manual, and arrange for the readings to be done. If an examinee does not keep his appointment for his reading, notify the FMA and see that the examinee is rescheduled for the reading. Call the FMA at the end of each session (except evening) about the tuberculin tests given, read, and appointments made for reading.
- (4) Complete the required items on the CDC report form.
- (5) Assist the physician in his examination of detailed examinees except during the administration of medical history supplements.
- (6) Chaperone the dermatologist's and physician's nutrition examinations and help with arriving examinees as requested by the coordinator.
- (7) Try to provide to each examinee a feeling of continuity throughout the examination, in this way perhaps making the examinee less anxious and more comfortable during his stay in the exam center.
- (8) Complete and review certain parts of the physician's "Report of Findings" (see page 3-18), and to review certain completed records (see page 3-19).

- (9) See that certain data are transmitted from the field according to the instructions in Chapter III of the HANES *Field Operations Manual*.

#### B. Additional responsibilities

- (1) See that the photo log and authorizations are kept up to date daily.
- (2) See that cultures, biopsies, and letters to physicians get mailed when done.
- (3) See that the appearance of the examination areas, the equipment, and the inventories of supplies for ophtalmology, dermatology, and physician's examinations and venipuncture are maintained.
- (4) Change Cidex solutions at least every 5 to 10 days as needed.
- (5) Recharge the otoscopes over each weekend.

#### C. Responsibilities at the beginning of each stand

- (1) Check new supplies with the new inventory list; then put the supplies away.
- (2) Complete the beginning of stand inventories and give them to the coordinator.
- (3) Set up the physician and dermatology rooms for use, making sure all equipment works and supplies are adequate.
- (4) Set up the ophthalmology room or assist the new ophthalmologist in setting it up.
- (5) Check with the FOM to see when new physicians are coming and orient them to the trailers, survey in general, procedures, and introduce them to the staff.

#### D. Responsibilities at the end of each stand

- (1) Do the physician and dermatology room inventories, and see that the ophthalmology room inventory is done.
- (2) Give the unusual occurrence forms from the physician, dermatology, and ophthalmology rooms to the coordinator.
- (3) Xerox the Tuberculin Log for the stand and give it to the FMA.
- (4) Assist the coordinator with her responsibility for transmitting Fungus Culture Reports, Skin Biopsy Consents, and Biopsy Reports from the field to headquarters.
- (5) Pack the physician and dermatology rooms for travel, and see that the ophthalmology room is done (preferably by ophthalmologist).

#### E. Procedure for mailing film

- (1) Place the exposed roll of film in the metal film container that it came in.



- (2) Address the mailer to the nearest Kodak Laboratory as listed on the cardboard envelope.
- (3) Write the return address as follows:

Medical Officer, Operations and Quality Control Branch  
Rm 8A-40, Parklawn Bldg., NCHS  
5600 Fishers Lane  
Rockville, Maryland 20852

- (4) Fill out the stub from the mailer and tear it off.
- (5) Put the container of film in the envelope and mail it using the "Postage and Fees Paid U.S. Department of HEW" corner from our official mailing stickers as the stamp.
- (6) Mail to headquarters (same address above) a copy of the photo log with caravan number, stand location, mailer number, and the record stub from the mailer.
- (7) Reload the camera with proper film (color slides, ASA 25), saving the metal film container, and tape the back of the film box with a description of the film to the back of the camera.

## 8. Ophthalmologist

In addition to the general responsibilities of all examination staff members it is the responsibility of the ophthalmologist to:

- A. Arrive for work 15 minutes before the first examinees scheduled.
- B. Review the appropriate sections of the previously completed medical history questionnaire referring to specific history of eye and related conditions; review at the time of the examination those pertinent "positive" responses on the questionnaire in order to clarify certain points and aid in the overall assessment of the eye.
- C. Carry out an ophthalmologic examination in a uniform way as outlined in this manual. Try to do Ophthalmology I in about 8 minutes and Ophthalmology II in about 6 minutes. The maximum time allowed is 12 minutes for the first part of the exam and 8 minutes for the second part. You should complete the examination within the maximum time; but, if that is impossible, it is more important to stay within 20 minutes (12 and 8) than to finish the examination. If you cannot complete your exam within 20 minutes (12 and 8), write "max. time" as the reason for non-completion on the control record. In trying to stay within the maximum time do not rush the exam to such an extent that you feel the quality of the data that you do get is reduced. If part of an examination is missed due to the maximum time rule, it may be possible to finish the exam later provided that the examinee has finished all his other examinations

and is perfectly willing to remain longer, and that you have finished all your other examinations.

- D. Complete the appropriate section of the "Report of Findings" form (see page ).
- E. Review the ophthalmologic form before dismissing the examinee to insure that all sections are completed, particularly the diagnostic section, and that abnormalities checked off on the examination sections are included in the diagnostic section.
- F. Complete the time sheets (on several stands) specifying the times when each portion of the eye examination is initiated and completed.
- G. Refrain from answering medically related questions raised by examinees pertaining to the eyes; this should be done by their private physicians.
- H. Assist the examining physician in providing whatever emergency care is necessary, given the available resources, should the need arise.
- I. Contact an examinee's personal physician, clinic, or private ophthalmologist whenever an ophthalmological condition requiring early or immediate attention is noted during the course of the examination. If the examinee does not have a private ophthalmologist, his private physician should be asked to recommend one. If the examinee does not have a private physician, a list of physicians and eye clinics obtained from the local medical society will be made available by the coordinator; the examinee should be referred to someone on that list who should be contacted by phone regarding the emergency. Do not treat an examinee in the exam center unless it is an emergency that cannot wait for the examinee to see the referral physician, or the condition results from the examination. Osmotic agents and other drugs have been provided for such a situation.
- J. Be familiar with the "Medical Policy Regarding the Examination."

## 9. Physician

In addition to the general responsibilities of all examination staff members it is the responsibility of the physician to:

- A. Arrive for work 15 minutes before the first examinees scheduled.
- B. Review the medical histories and general medical supplements before the arrival of the examinees and notify the coordinator if any section of the routine examination should be omitted or altered for any examinee or if the physician should further question or examine any examinee prior to undertaking any section of the routine examination (see responsibility F).
- C. Review pertinent "positive" responses, clarify questionable or inconsistent information, and update the histories at the time of the examination so that the histories are correct and current.

- D. Carry out a complete physical examination as outlined in this manual in a uniform way, insuring complete data collection on all those findings which are of primary importance to the survey. Try to do the nutrition physician's examination in about 10 minutes and the detailed examination (including TB test and any supplements) in about 25 minutes. Any supplements in the detailed exam should be done last. The maximum times allowed for these exams are 15 minutes for nutrition and 25 minutes for detailed exam plus 7 minutes for each supplement; e.g., 39 minutes for an examinee with two supplements. You should complete an exam within the time allowed; but, if that is impossible, it is more important to stay within the maximum time than to finish the exam. If you cannot complete your exam within the maximum time, write "max. time" as the reason for noncompletion on the control record. In trying to stay within the maximum time do not rush the exam to such an extent that you feel the quality of the data that you do get is reduced. If part of an examination is missed due to the maximum time rule, it may be possible to finish the exam later provided that the examinee has finished all his other examinations and is perfectly willing to remain longer, and that you have finished all your other examinations.
- E. Administer the supplemental histories "A" (Arthritis), and/or "B" (Respiratory), and/or "C" (Cardiovascular) if indicated. Each section of an administered supplement should be completed in detailed.
- F. Assess the status of the examinee and decide if any sections of our routine examination should be omitted. For instance, examinees with acute upper or lower respiratory tract infections or with active tuberculosis (including those still on chemotherapy) should be excluded from both CO diffusion and spirometry studies to prevent contamination of the machinery; and examinees with recent abdominal surgery, incipient delivery or complicated pregnancy, or active angina pectoris might have to be excluded from spirometry to prevent damage to the examinees.
- G. Assist in the blood-drawing and EKG recording when requested. In the event that the nurse is absent from work the physician assumes responsibility for administering tuberculin skin tests and arranging for them to be read, and should do those parts of the detailed examination normally done by the nurse.
- H. Read all X-rays and EKG's prior to the examinee's leaving the examination center. (Initial those of acceptable quality, and have those of unacceptable quality repeated prior to initialing.)
- I. Arrange medical care for examinees ill or injured in the exam center or needing medical attention prior to the time that the routine reports will be mailed (use 2 months as a guideline) according to the "Medical Policy Regarding the Examination." If possible, this care should be delivered by the examinee's own health delivery system or by the ambulance and emergency room service listed in the exam center. In those

- instances where immediate care in the exam center is necessary, you should direct this care.
- J. Complete the physician's section of the "Report of Findings" so that any significant new medical findings are called to the attention of the examinee's physician.
  - K. Be present within the examination center until the last examinee has completed his examination (excluding any questionnaire completion). This responsibility for "late" coverage may on occasion be assumed by another physician as outlined under the responsibilities of the dermatologist.
  - L. Promptly notify the Field Operations Manager and/or the medical officer of the headquarters Operations and Quality Control Branch, if because of illness or any other reason, you are unable to discharge any of your duties.
  - M. Be familiar with the "Medical Policy Regarding the Examination."

### Responsibilities for Completing the Control Record

Each member of the staff is responsible for filling in the section of the control record pertaining to the procedure he performed. This involves entering the time of the start and end of a procedure and the number of the staff member performing the procedure. If a procedure is not done, the reason must be recorded under "Procedure or part of overall procedure not done." If a part of the procedure is not done—e.g., tonometry in the ophthalmological exam—the reason for the omission should be noted on the control record.

Staff members should pay particular attention to the "Special Notes" section. This section is filled in by the coordinator from the Daily Appointment Schedule and indicates any special consideration or action involving the examinee. As examples, an entry of "No X-rays" must be noted by the health technician, and the procedure should not be performed; "Child is a diabetic, should eat his lunch which he has with him at 12 o'clock" must be noted by the staff members as appropriate. In the example of "No X-rays," the reason—usually "Dr's orders" or "Parents' objection"—should be ascertained and entered under "Reason Not Done" by the responsible health technician. Similar considerations apply to other staff members responsible for other procedures which are indicated as not to be performed.

### Responsibilities for Completing the Report of Findings to Physician

#### I. Coordinator

Enter the name and address from the authorization form of the physician or clinic to whom results are to be sent. Stay within the box outlines since the form has been designed for a window envelope. Enter the name and address of the examinee from the top of the medical history form. Enter the exam date, age, and sex from the control record. It will be the overall responsibility of the co-

ordinator to assure that all staff members have made their appropriate entries and that the form is complete.

2. Physician, dermatologist, and ophthalmologist

Boxes are provided for each of the three physicians to check if there are no significant findings for their respective exam. If there are significant findings for which no treatment had been sought and/or no history given, they should be reported. If the box is not checked or no significant findings reported, the coordinator will return the record to the physician for completion.

3. Ophthalmologist

In addition to the above, the visual acuity must be entered and the appropriate box checked indicating whether the examinee was tested with glasses, without glasses, or with contact lenses.

4. Health technicians

The technician administering the procedures is responsible for entering height (in inches) and weight on all reports, and the results of the audiometry on the reports for detailed examinees. The X-ray and EKG boxes will be checked at headquarters when the report is mailed.

5. Nurse

Enter the results of the TB test at the same time they are entered on the chart.

6. Laboratory technician

A. Reports for detailed examinees

Enter each day values for all of the blood and urine tests done in the examination center. These can be entered from the results recorded on the laboratory worksheet.

B. Reports for nutrition examinees

- (1) If no new significant findings are reported by any of the three physicians and there are no abnormal blood or urine values, place a check in the box in the lower left portion of the report.
- (2) If any significant findings are reported by any of the three physicians or if there are any abnormal blood or urine values, enter the values for all of the blood and urine tests.

7. As a matter of general information, these reports will be mailed from headquarters. Each detailed examinee will have a report sent which will also include a copy of the chest X-ray, the EKG tracing, and a machine print-out of almost all of the lab work performed at CDC.

The nutrition examinees will have a report mailed only if there are significant findings noted by any of the physicians or if there are any abnormal lab values from our lab or from CDC. In the event any of these occur, then a complete findings report will be mailed (including our lab results) along with a machine print-out of the CDC lab results.

#### Responsibilities for Checking HANES Documents in the Field

1. Records to be checked

- A. Examination Case Record
- B. Dermatology form
- C. Ophthalmology form
- D. Medical History Supplements A, B, and C
- E. Medical Histories 1-5, 6-11, 12-74, and 25-74
- G. General Well-Being questionnaire

2. What to check for

- A. Blanks

These may be a whole section or only a part. There may be a positive or "yes" answer to one part which necessitates something being written in the second part, which has, however, been left blank.

- B. Contradictory entries

An example would be a statement that the examinee had never seen a dentist or doctor followed by extensive descriptions of medical or dental care in a following section. Another example might be a "no" answer to a question of trouble seeing, but a "yes" answer on trouble with vision even when wearing glasses.

- C. Miscellaneous errors including

- (1) Writing in an "other" category which should have been specified in an included code; for example, dry skin written in "other," code 038, when code 035, "dry skin," is available.
- (2) Two answers where only one is allowed. Records produced by the non permanent staff are especially prone to errors due to some unfamiliarity with the forms.

### 3. Assignments

- A. Physician: Medical Histories 1-5, 6-11, 12-74, and 25-74.
- B. Nurse: Medical History Supplements A, B, and C; nutrition and detailed physician's exam; and dermatology exam.
- C. Coordinator: Remainder of case record including ophthalmology exam.
- D. Dietary Interviewer: Health Care Needs and General Well-Being.

All records should be checked over so that corrections can be made or missing data obtained while the examinee is still in the exam center.

The physician will be furnished the medical histories by the office staff and he should complete checking prior to the start of examinations.

The nurse and the coordinator will be required to check out examination records during the examination session and to request the physician, dermatologist, ophthalmologist, and technicians to make corrections as indicated. The nurse should check all detailed medical histories to see that the proper supplements have been administered and that the necessary changes have been made on them if the physician has ruled out any supplements. Dietary interviewers should pay special attention to checking over the General Well-Being forms that are self-administered since these are especially prone to errors. Errors in the Food Programs questionnaire will be brought to the attention of the coordinator by the FMA and should be corrected by the coordinator.

After checking the record, the person doing the checking should place his or her initials in the lower left-hand corner of the document.

### 4. Importance of review

The objective of the review is to see that we obtain the best data possible. Missing data are no data, and while imputation procedures can be applied in some instances, there is no substitute for complete and accurate data. The information obtained on these documents will be given directly to persons in data preparation who will code and punch only what they see in front of them, without giving thought to correcting apparent errors. This will provide misleading information which becomes greatly magnified in the process of inflating our sample to national estimates. If caught in time through computer editing procedures, some corrections can be made but the cost of these corrections in terms of time and money is very high. It is hoped that you will provide every assistance possible in doing your assignments to the best of your abilities.

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**CHAPTER 4**  
**EMERGENCY MEDICAL PROCEDURES**

In the event of a medical emergency at the mobile examination center, the following procedures will be followed.

1. The best method is prevention. The examining physician can at his discretion with good medical judgment void certain procedures such as respiratory tests if the testing will lead to any endangering of the examinee's health.
2. Prior to the beginning of examinations, including "dry runs," the FOM will have the responsibility for obtaining information on the types and availability of emergency medical services in the area in which the mobile examination center is located. This should include emergency medical services available from police or fire rescue squads, other county or local rescue squads, and hospital ambulance services, as well as the nearest medical facility. The FOM will select the best services available from the standpoint of convenience to the mobile examination center and availability of service and equipment. In some cases it may be desirable to select two. He will then post the names and phone numbers of the services he has selected in a conspicuous place near the phones in the center and the offices. For other reasons, the numbers of the nearest police and fire stations will also be posted.
3. The following emergency equipment will be available, inventoried by the nurse, and kept in the physician's room. All equipment will be checked by the nurse and the physician at the start of each stand.

- A. Oxygen
- B. Bag and mask
- C. Disposable oral airways - small, medium, and large (4 of each)
- D. Drugs

Atropine 1/150 gr. in single dosage form which must be reconstituted for use. Four doses supplied.

Valium injectable 5 mg/cc. Four vials supplied.

Epinephrine 1:1000 in small vials. Four vials supplied.

50% oral glycerol soln. Four 3-or 4-oz. bottles supplied.

Xylocaine 1% already at MEC

The drugs will be used for the following situations:

Myocardial infarction - atropine for bradycardia

xylocaine for arrhythmia

epinephrine for cardiac arrest

Seizures - valium IV. In small children do not push more than 1cc (5 mg) at start for respiratory depression is common.



Severe asthmatic attack - epinephrine. The childhood dose is 0.01 ml/  
kg with a max. of 0.04 cc.

Allergic reaction, severe - epinephrine

Acute angle closure post eye drops - glycerol soln.

4. All emergency procedures and the use of all emergency equipment will be handled by the physician (PHS). If he is unavailable, one of the other physicians will be in charge.
5. The use of this equipment is for *emergency situations only*.
6. The primary concern of all the field staff is to get the person to the nearest medical facility, and the emergency equipment is not to be used in lieu of this.
7. All persons seriously ill or who received emergency care at the examination center will be accompanied to the hospital by the physician. The person's private physician will be contacted as soon as possible by the nurse.
8. A short report will be made and signed by the physician and the nurse as to the medical problem and how it was handled. This report will be sent to the Medical Advisor at headquarters.

# PART II. PROCEDURES

## CHAPTER 5

### COORDINATOR

#### General

Efficient coordination of the flow of examinees through the examination center is the most important function of the coordinator. In addition to this, the coordinator has other responsibilities which are described in this chapter.

#### Coordinating the Flow of Examinees

1. Sometime during each session see that the charts for the next session are ready for use. Review the medical histories and check the daily schedule for any notes from the administrative office regarding unusual requests or instructions. If there are unusual instructions, they should be noted on the examinee's control record. Then give the medical histories to the examining physician to review. The coordinator should advise the Field Management Assistant (FMA) of any discrepancies in sample numbers, but in no instance should she change a sample number without first confirming the change with the FMA.
2. Arrive for work 30 minutes before the first scheduled examinee.
3. Have the laboratory technician and dietary interviewers help get the examinees ready for their examinations so that you do not have to leave the reception area. Try to spread the work fairly evenly among these helpers. The first detailed examinee and first replicate nutrition examinee should be given immediately to the appropriate health technicians who should help them change and take them to the tech block and dental/body measurements respectively.
4. Coordinating
  - A. Basic rule for pairing examinee with examiner
    - (1) If several examinees are waiting, the examinee who has been waiting the longest since the time he was last seen should be served first. However, detailed examinees have priority over nutrition examinees.

- (2) If several examiners are available to an examinee, the following priorities determine who serves the examinee. Assuming the rules are followed, a low priority does not necessarily mean that an examiner's work will be done at the end of a session.

Nutrition	Detailed
1. Venipuncture	1. Venipuncture
2. Change	2. Change
3. Body Measurements - Dental Exam	3. Body Measurements - Dental Exam - Goniometry
4. Ophthalmological Exam I	4. Technician Block
5. AM - Physician's Exam PM - Dermatologist's Exam	5. AM - Physician's Exam PM - Dermatologist's Exam
6. Dietary Interview	6. Dietary Interview - Ques- tionnaires
7. AM - Dermatologist's Exam PM - Physician's Exam	7. Ophthalmological Exam I
8. Ophthalmological Exam II	8. AM - Dermatologist's Exam PM - Physician's Exam
9. X-ray (1-17)	9. Ophthalmological Exam II
10. Body Measurement Replicate (for selected examinees)	

B. Exceptions and notes to basic rule

- (1) Ophthalmology II cannot be assigned until at least 20 minutes after Ophthalmology I. But if after 50 minutes Ophthalmology II has not been done, it takes precedence over all else (except whatever part of the exam the examinee is in at that time). If a detailed examinee has had Ophthalmology I before the tech block, the coordinator should tell the technician that he is responsible for bringing the examinee back to the coordinator to wait for assignment to Ophthalmology II, about 50 minutes after the end of Ophthalmology I. After Ophtha-

Imology II the examinee goes immediately back to the technician to finished the tech block.

- (2) On days with at least one detailed examinee, if all bloods haven't been drawn within 2½ hours after the beginning of the session hold examinees (whose blood hasn't been drawn) and the nurse and don't assign anyone to dermatology until all bloods are drawn. On days with no detailed examinees, if all bloods haven't been drawn within 2 hours after the beginning of the session follow the same procedure.
- (3) For morning sessions the dermatologist is responsible for staying in the trailers until the last examinee has finished all parts of the examination (except any questionnaires). For afternoon and evening sessions the physician has the same responsibility. When the dermatologist provides late coverage his examination should be seventh on the nutrition priority list and eighth on the detailed list. Likewise, when the physician provides late coverage his examination should be seventh on the nutrition priority list and eighth on the detailed list.
- (4) Dietary interview (questionnaires), Ophthalmology I and II, and X-rays (1-17), as well as venipuncture can be done before dressing or after redressing.
- (5) The first detailed examinee to arrive for each session should be assigned to the designated health technician who will have him change, void, and go on to the tech block. He should be assigned to the rest of his examination according to the regular priorities. However, on heavily scheduled days the bloods may get to the lab faster if you send the first detailed examinee to venipuncture before the tech block.
- (6) For sessions in which a body measurement replicate is scheduled the first nutrition examinee to arrive should be assigned to the designated health technician who will have him change, void, and go on to dental exam/body measurements. He should be assigned to the rest of his exam according to the regular priorities.
- (7) Only one technician block can be assigned at a time—other technician should be free to work with the dentist.
- (8) Nutrition examinees, aged 1-17, should get hand-wrist X-rays during the dental/body measurement block if the X-ray room is available. If not available, hand-wrist X-rays should be assigned according to the priorities. Either health technician can do hand-wrist X-rays.
- (9) If a mother and child are in the examination center during the same session the mother should be the respondent for the child's dietary interview if the child is less than 12 years old. The child should be the respondent for his own dietary interview if he is 12 or older. When dietary interviews for detailed examinees are done in the trailers, assign them to be done in the same block of time (maximum time = 55 min. = 30 + 25) as the questionnaires.

- (10) If a small child is apt to become so unglued by the blood drawing operation that other parts of the exam may suffer, save venipuncture until last.

C. How to know what examiner is available

For sessions when there are few examinees you can probably remember which examiners are free at any time. But on heavily scheduled days the following system may help:

Each examiner has a card except for the nurse who has two—one for blood drawing and one for chaperoning. As an examinee is assigned to an examiner you should clip that examiner's card to the chart. The cards remaining show which examiners are still free. Since the dermatologist examines in the venipuncture room, before assigning anyone to dermatology or to venipuncture be sure that both dermatology and nurse-venipuncture cards are visible. Likewise for any part of the exam that must be chaperoned be sure that a chaperone's (dietary interviewer or nurse) card is available.

D. Other rules

- (1) The nurse must participate in all detailed physician's examinations except during the administration of supplements. After the actual examination she should return her card to you so that you will know she is available for drawing blood and chaperoning. Female examinees aged 10 and above should be chaperoned during the physician's nutrition examinations and dermatologist's examinations, if the examiners are male. If a female laboratory technician or dietary interviewer is available she should chaperone, if not the nurse. If none of these are available the examination must wait.
- (2) Family groups should be treated as any other examinees unless they *insist* on going through the examination together.
- (3) If any of the second group of examinees is more than 45 minutes late be sure that he has the physician's exam, blood drawn, and body measurements taken before any other part of the examination is done. If after these three exams there is at least one other examinee in the trailers, the late examinee should continue the nutrition examination until the last other examinee is finished. At which time he is also finished, notwithstanding any parts of the exam not completed. However, arrangements should be made for him to return at another time to finish the exam.
- (4) Maximum times for the components of the HANES examination are given below. The responsibility for staying within their time limit

is with the individual examiners. When reviewing a chart, check the control record to see that the examiners did not exceed their times. If any did, remind them of the importance of adhering to maximum times even at the expense of some data. But if the same examiner exceeds his maximum more than a few times, call headquarters (one of the medical officers of the Operations Branch).

	Nutrition	Detailed
Physician's Examination and TB	15	25 (+ 7 times number of supplements)
Dermatologist's Examination	15	15
Ophthalmology I	12	12
Ophthalmology II	8	8
Venipuncture	10*	10
Technician Block (EKG-Spiro, Lung Anal., X-rays, Audio.)	--	80 (about 20 min. each)
Dental-Technician Block		
Dental Exam	15	15
Body Measurements	10	10
Goniometry	--	10
X-rays (1-17)	5	--
Dietary Interview	30	30
General Well-Being and Health Care Needs	--	25

\*Small children who have the venipuncture at the end of their examinations may have a maximum time of 15 minutes.

If part of an examination is missed due to the maximum time rule, it is possible to finish the exam later provided that the examinee has finished all his other examinations and is perfectly willing to stay longer and that the examiner has finished all his other examinations.

##### 5. Assignment of detailed examinees to technicians

At the beginning of each stand the two health technicians should be associated with either "A" or "B" on the Schedule Sheet and should keep their letters until the end of the stand. The arrival time and sample number of the first detailed examinee of the session should be recorded on the Schedule Sheet which indicates which technician is to be the

examining technician. The first detailed examinee should have his temperature taken, change, void, and then be assigned (immediately) to the technician block. The technicians are responsible for screening examinees before the spirometry and lung analyzer tests, and sometimes a technician may decide that the examinee needs to see the physician first. If so, he should inform you so you can assign the examinee to the physician (with high priority). After the tech block is completed, the first detailed examinee should be assigned to the rest of his exam according to the given priorities.

The second detailed examinee's arrival time and sample number should be recorded on the Schedule Sheet. Assign him according to the priorities, making certain that when he is assigned to the tech block the proper technician is available.

It is important that the Schedule Sheet be filled out ACCURATELY and LEGIBLY since this information is punched for computer consumption just as other data gathered by the survey.

#### 6. Assignment of first nutrition for body measurement replicates

For each session for which there is a space provided on the Schedule Sheet (in the "Sample Number of First Arriving Nutrition Examinee" column) record the sample number of the nutrition examinee who arrives first. The technician indicated to the left of the space should do the original body measurement examination. This first nutrition examinee should have his temperature taken, change, void, and then be assigned immediately to body measurements/dental. The remaining parts of the exam should be assigned according to the given priorities. The replicate examination should be assigned according to priorities when the other technician is available to do the replicate. The forms marked "REPLICATE" should be used for this examination. You should keep the examinee's chart at your desk while the replicate examination is being done.

#### 7. Overscheduling

The office will not overschedule unless it is necessary to avoid missing examinations. The system for assigning examinees will not change when there are extra nutrition examinees, but when three detailed examinees are scheduled the office will try to schedule one of them approximately 45 minutes before the regular time. The coordinator should then arrange to have one of the health technicians arrive early and start the tech block immediately. Both in the case when one of the three detailed examinees is early and in the case when all three are scheduled at the regular time, it is important to assign only one tech block at a time unless all dental-body measurements have been completed.

8. Quickly review for completeness and consistency each chart as it is returned by the last examiner. Have all errors corrected unless they are blanks because of a partial examination as a result of enforcement of the maximum time rule.
9. See that transportation from the examination center is available for each examinee when he is ready to go.
10. The coordinator should stay until the last examinee leaves the trailers. However, most examiners can leave when finished with all their exams after first checking with the coordinator.

#### Communication Between FOM and Examination Staff

The coordinator is the channel of communication between the Field Operations Manager (FOM) and the examination staff as far as operational matters within the examination center are concerned. She should report to the FOM any problems that occur during the examination which require contact with the family, physician, school, etc. She should inform the exam staff of any schedule changes and reasons for them as she receives them from the administrative office. She should also inform the FOM of any necessary repairs to or reordering of faulty equipment as soon as possible.

#### Forms to be Sent to Headquarters

The coordinator is responsible for providing all examination staff members with "unusual occurrence" forms at the beginning of each stand. These forms should be posted in all examining areas for the use of the examiners. At the end of each stand the following forms should be sent to headquarters, Quality Control Section:

1. Schedule Sheet
2. Copies of all detailed examinees' body measurement forms
3. Copies of audiometry forms
4. Copies of goniometry forms
5. Copies of respiratory function test forms
6. Nutrition replicate forms
7. Unusual occurrence forms



**CHAPTER 6**  
**DIETARY INTERVIEWER**

Procedure

1. Obtaining background information

During the first few days at each new stand the dietary coordinator is responsible for:

- Obtaining background information about local foods and available food programs which will be shared with dietary interviewers.
- Making or arranging for home visits to collect dietary data from examinees in detailed examination (referrals from HER's).

A. Background information

Information about food customs, food terminology, and specialty and cultural foods typical of the area will be learned by meeting with the public health and/or Agricultural Extension Nutritionists, or hospital or clinic dietitians. Assistance in identifying and conducting the appropriate persons will be provided by Miss Youland. During the informal meeting the topics to be covered are outlined in Table A.

TABLE A

Examples of Information to be Discussed During Visits to Nutrition/Dietetic  
Personnel at Each New Stand

1. Foods typical of area, of ethnic or cultural significance, etc.
  - a. Those likely to be used during survey period.
  - b. Food value, preparation methods, data on food composition.
  - c. If limited to geographic area, is it within survey area?
  - d. Location of stores or markets where items can be seen or purchased.
  - e. How extensive is home growing, canning, freezing?
2. Food terminology
  - a. Local names/colloquialisms for common foods or food preparation methods.

### 3. Background about food programs

- a. Availability and location of school breakfast programs—type of meal served?
- b. Availability of school lunches—are they type A?
- c. Availability of summer school and/or day care feeding programs.
- d. Vending machines in schools—kinds of foods available.

### 4. Possibilities/suggestions for referrals for dietary followup

- a. Availability of diet counseling for persons on therapeutic diets.
- b. What services available to homemakers needing assistance re: food budgets, food preparation, nutrition information, etc.
- c. Procedures for making referrals.

Separate telephone calls or visits may be necessary to obtain additional information about 1) the type of school breakfast or lunch programs served in the area, and 2) pertinent information about food stamp or donated commodities programs. Miss Youland and the local public health or extension nutritionists will provide assistance regarding whom to contact for this information.

#### B. Visits to grocery stores and markets

These visits are to be made at the beginning of each new stand in order to obtain information that will make dietary interviews easier to conduct, understand, and interpret or code. The following are some of the purposes of these "market checks:"

- (1) To become acquainted with trade or brand names, local food terminology, and new products.
- (2) To observe the quality and types of meat, fish, poultry, breads, and vegetables and fruits available.
- (3) To note package and can sizes as well as prices of items, particularly those which have not been observed at previous locations.

During the time of operation at any location additional visits to grocery stores and markets are usually necessary to check unit sizes, new or unfamiliar items. Responsibility for such visits is shared among dietary interviewers.

## 2. Home visits

### A. Persons to be seen

Sample persons scheduled for detailed examinations should be visited in their homes prior to the beginning of examinations in order to collect dietary data. Both the coordinator and dietary interviewer should plan to make such

visits on the day scheduled for staff set-up and training and possibly one of them on the "Dry Run" day. The purpose of these visits is to lighten the dietary work-load the first week or two of the stand when it may be unusually heavy.

In addition, home visits may be necessary to interview the parent or person responsible for feeding a child *when* this person does not accompany the child to the examination center. Occasionally home visits may be made to obtain dietary data from nutrition examinees due to special circumstances.

#### B. Scheduling visits

Appointments for home visits to detailed examinees should be scheduled by telephone when the Health Examination Representative (HER) indicates this is desirable or when the examinee lives in an area not easily accessible to the mobile examination center. Appointments for interviews with parents or guardians or other nutrition examinees may be made by telephone or at the time the individual is examined at the center.

When a home visit is necessary to complete an interview begun at the examination center, the visit should be completed within 48 hours of the initial interview. Otherwise use a new form and try to obtain a 24-hour recall for the day preceding the home visit.

If an absent visit is made, whether by appointment or not, an effort should be made to contact the sample person before another visit is attempted.

#### C. Making the visit

Whenever possible a government vehicle or public transportation should be used for making home visits.

Except in unusual circumstances home visits by dietary staff should be made before 7 p.m. Every effort should be made to see persons in their homes or place of employment during normal work hours on Monday through Saturday.

### 3. Log book

#### A. Description

Two dietary logs are maintained at each location—one in each of the interviewing rooms at the examination center. The main purpose of the log is to keep a current, accurate record of all persons interviewed, when and where they were seen and by whom.

## B. Maintaining the log

The log book in each interview room contains the name, segment, and serial number of persons interviewed at the examination center or at home, plus interviewer number and pertinent comments recorded by the interviewer who saw the individual. A new page is begun daily with the date inserted at the top of the page. Information about examinees seen at home is recorded under the date they are scheduled at the center.

## 4. Transmittal of completed forms to headquarters

Log books are used to verify that all dietary interview forms<sup>2</sup> have been checked and sent to headquarters; therefore each log entry should be accounted for at the end of the stand.

After forms are checked against the log, complete form HSM 565-A, "Record of Transmittal," Circle the appropriate sample numbers to account for all records being mailed.

Completed forms (24-hour recall and food frequency) are to be mailed by "Registered Mail" to headquarters at the end of every 3-week period and at the end of each stand. All forms from a stand must be completed (i.e., coded and checked by another interviewer) and mailed before interviewing begins at a new stand.

The dietary coordinator is responsible for accounting for forms and mailing them at the end of each stand. Packages should be securely wrapped in Jiffy Bags, reinforced if necessary so that the contents are not crumpled in transit.

Send packages by "Registered Mail—Return Receipt Requested" and address as follows:

Mr. Sidney Abraham, Chief  
Nutrition Statistics Branch, DHES  
National Center for Health Statistics, HSMHA  
5600 Fishers Lane  
Rockville, Maryland 20852

## 5. Provision of nutrition advice or counseling

The purpose of dietary interviews is to collect specific information about food intakes and dietary habits. It is important that such information be obtained without approval, disapproval, or any advice from the interviewer.

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<sup>2</sup>There should be two dietary forms for each sample person--if not, please attach explanatory note.

At the completion of an interview the respondent may be given any or all of the following publications that the dietary interviewer feels are appropriate.

*Food for Fitness.* U.S.D.A., leaflet No. 424, 1967.

A daily food guide which describes the 4 food groups which are the basis of an adequate diet for all persons.

*Facts about Nutrition.* U.S.D.H.E.W., P.H.S. Pub. 917, 1968.

Contains a brief explanation of the needs for and sources of vitamins and minerals. Daily food needs of persons of various ages and conditions are outlined.

*Your Money's Worth in Foods.* U.S.D.A. Home and Garden Bulletin No. 183, 1970. Directed to homemakers. Emphasis is on shopping for foods and meal planning.

The distribution of nutrition literature is on a selective basis and should be based on the recipient's expressed interests and need as well as his ability to use the material. As much time as possible should be spent reviewing the selected publications with the recipient.

Individuals who have questions and/or problems related to prescribed diets should be referred to community resources or to the hospital or physician initiating the prescription. Persons with specific questions about food budgets, use of food stamps, requests for recipes, and so forth should also be referred to community resources. The dietary coordinator will know or will obtain information about the location and types of such resources.

#### 6. Visitors to the mobile examination center

From time to time dietitians and nutritionists and other professionals may contact the dietary staff about visiting the examination center. Explain to such persons that to avoid congestion and to protect the confidentiality of examinees, visiting times are limited to times when the center is not operating, e.g., the afternoon of a day scheduled as a split shift.

Arrangements for visitors to tour the center should be made in collaboration with the field operations manager, and generally it is desirable to refer prospective visitors to him directly. The dietary coordinator or at least one dietary interviewer should plan to be on hand when visitors are scheduled at the mobile examination center.

## 7. Recording dietary interviews

In order to help dietary interviewers maintain consistent interviewing practices and observe established instructions and procedures, each interviewer will record at least two complete interviews at each location.

The selection of subjects, interviewers, and dates for recording will be determined randomly at headquarters and forwarded to the dietary coordinator prior to the beginning of each new location. Completed tapes are to be mailed in Jiffy Envelopes to:

Miss Dorothy Youland  
Nutrition Statistics Branch, DHES  
National Center for Health Statistics  
5600 Fishers Lane  
Rockville, Maryland 20852

The following guidelines will be used in connection with tape-recording dietary interviews.

- A. Permission of the examinee must be obtained before the recorder is started. For example you may state "as part of a quality control procedure we record randomly selected dietary interviews. May I have your permission to record our interview?" If the person hesitates you may add "the tape will be used only to control and improve our interviewing techniques and you will not be identified." If he still hesitates, proceed with the interview but *do not record it*. Proceed to ask each succeeding examinee for permission until the required number of interviews has been completed.
- B. On days interviews are to be recorded the equipment should be set up before the examinee is admitted to the interviewing room.
- C. Each interviewer should start with a new or clean tape. Read onto the tape before commencing the interview: a) name of interviewer, b) sample number of interviewee, and c) date and place of interview.
- D. Before the tape is sent to Rockville the interviewer should listen to it (preferably with other dietary staff) to note strengths and weaknesses in her techniques, areas needing improvement, etc.

## 8. General Well-being and Health Care Needs

Dietary interviewers administer the following questionnaires to detailed examinees at the examination center:

General Well-Being (Form HSM 411-7)  
Health Care Needs (Form HSM 411-6)

The General Well-Being questionnaire should be done before the Health Care Needs.

## A. General Well-Being

### (1) Purpose

The General Well-Being questionnaire was developed to obtain information to serve the following purposes:

- (a) To serve as a "moderator variable" or control in the statistical assessment of medical needs. That is people who are emotionally disturbed most likely will have more complaints about unmet medical needs, and of medical services actually rendered.
- (b) To collect information on psychologic services needed and prevalence on use of some services as indicated in questions 19-25.
- (c) To serve as an indicator of *overall* adjustment (questions 1-18).
- (d) To provide some differential indicators, or sub-scales, of adjustments as follows (questions 1-18):

Worry or concern about health (questions 10,15)

Energy level (questions 9, 14, 17)

Satisfied, interesting life (questions 6, 11,)

Mood—cheerful vs. depressed (questions 1, 4, 12, 18)

Emotional stability and control (questions 3, 7, 13)

Tension (questions 2, 5, 8, 16)

### (2) Approach

The General Well-Being questionnaire was designed to be essentially self-administered; however, probably 20-40 percent of the examinees will need help in reading the questions and following the instructions. It is *essential* that we obtain what the individual says about himself (or how he represents himself), not our judgment or evaluation of what we think he should say. Do not "put words" in the examinee's mouth. Let him represent himself. Your role is to help him accurately reflect what he wants to convey.

### (3) Procedures

- (a) After introducing yourself, if necessary, read or paraphrase the blocked in sentence on the first page while handing the examinee the form. Ask him to go ahead and fill it out while you observe.

Should it become apparent that he needs help in reading or understanding it, say something like "If you like, I will read it as you fill it out." Leave his form in front of him while you read from another form. Read back the questions and the response options if needed in a slow modulated tone. If he doesn't seem to understand, repeat slowly. Let him check his own answers if possible—if not you may check in front of him his verbal responses. Try not in any case to influence his answer choices.

- (b) In some cases you may have to translate, paraphrase, or rephrase a given question. If so, stick as close to the meaning of the question as possible.
- (c) Do not unduly "hurry" the examinee--give him time to think.
- (d) After the form is completed, check to see that every question is answered and there is only *one* response per question except questions 20-23. If not, call his attention to it and try to get a response. On the rating bar questions, 15-18, note to insure that he understands what is needed. Watch out for responses only at the ends of the bars. Have him *circle* a number which best represents his feelings.
- (e) If the response to a question seems unreasonable or inconsistent during review, *gently* call his attention to the question and ask "Did you mean to answer like this?"
- (f) On questions 19-23, if "yes" is checked to any of them try to verify that "yes" is what the examinee meant to check. You may say, gently: "I see you checked "yes" to question(s) X, is that what you meant to check?" On questions 20-23 both 1 and 2 responses may be checked.
- (g) When the interview is completed, fill out the last line on the form. Check: *examinee* if he filled it out with only *little* or no guidance; *interviewer* if basically read by the interviewer; *mixed* if considerable help and guidance was needed.
- (h) If the examinee does not fill out or complete the GWB still send in the form to headquarters with comments about why not. If the examinee is too mentally or emotionally disturbed or is incapable, at least try to obtain information on questions 19-25.
- (i) After reviewing the completed form the interviewer should initial the bottom of the last page indicating verification.



- (j) Since every GWB form will be reviewed, please feel free to make any comments or observations on the form including impressions or indications of good adjustment as well as limitations or signs of distress.

## B. Health Care Needs

Information on the Health Care Needs form is obtained by interviewing the examinee. Read each question, and all parts of the question, verbatim. Generally it will be possible to check the answer or answers according to the response of the examinee. When in doubt about how to interpret a response, read the possible answers to the examinee and ask him to select the correct one.

When necessary to clarify a question, try to paraphrase or rephrase it without changing the meaning of the original question.

## Guidelines for Completing Dietary Forms

### 1. General

#### A. Background information

Every effort will be made to obtain a 24-hour dietary recall and data about food frequency on each sample person examined by means of individual interviews with those ages 12 and over. Information about the food intakes of persons under age 12 will be obtained from the individual primarily responsible for feeding the child (parent, grandparent, baby-sitter, etc.). In the case of school age children both child and parent (or other responsible adult) may participate in the interview.

Persons scheduled for detailed examinations may be visited in their homes to obtain dietary information. On all other sample persons dietary data will be collected at the mobile examination center, except that home visits may be made if the mother or person responsible for a child's feeding does not accompany him to the examination center or if it is necessary to obtain additional information, such as from a baby-sitter who feeds a child regularly. (For more details about home visits refer to "Procedures.")

The sequence for completing the forms is the 24-hour recall first, the food frequency second. Information obtained about frequency is used as a cross-check of the 24-hour data.

B. Identifying information

(1) Columns 1-23 and 75-80

The first 23 columns on both the 24-hour dietary recall and food frequency forms are identical, and serve to identify the sample person. Columns 1-15 and 17-22 are from the Bureau of Census Form HES-5X that has been completed for the household. Information to complete column 23 is obtained from the completed Medical History Form (411-9 or 411-10). The identifying data except for column 16 are coded by the field management assistant before the forms are released to the dietary interviewer.

Column	Item and Explanation	Code
1-5	Sample No.—Refers to the number assigned to the sample person and is different for each respondent.	Actual number
6-11	Segment—Identifies a group of households within a small geographic area such as a city block.	
12-13	Serial—identifies the household within a segment.	
14-15	Column—Refers to the column listing respondent on the Bureau of Census Form (HES-5X).	
16	Respondent—The person or persons interviewed.	1-Sample person 2-Spouse 3-Parent 4-Grandparent 5-Combination of above 6-Other
17-22	Date of Birth—Record the month, day and year of the sample person's birth.	Month 01-12 Day 01-31 Year last two digits

23	"Sex"—Record according to information on Medical History Form No. 411-10. If subject is pregnant, code "3" if she has not reached the 5th month; code "4" if she has entered her 5th month of pregnancy.	1-Male 2-Female 3-Pregnant (first half) 4-Pregnant (second half) 5-Lactating 6-Lactating and in first half of pregnancy 7-Lactating and in second half of pregnancy
75-77	Interviewer's Code—Record the number assigned.	Actual number
78	Completion Code—Record appropriate code. When "2" is used indicate in the space provided why you feel data are unsatisfactory.	1-Completed satisfactory 2-Completed, unsatisfactory 3-Respondent, refused 4-Respondent not available 5-Respondent incapable 6-Other
Column	Item and Explanation	Code
79-80	Card Number.	Precoded
(2) 24-Hour Recall - Columns 24-35		
24-28	Weight—Record the weight to the nearest quarter pound as recorded on form- No. 425-7 (Body Measurements). Last two columns are decimals, although decimal point is omitted.	150 lbs = 15000 175 1/4 lbs = 17525
29-34	To be coded at headquarters.	
35	Day of week of recall.	1-Sun. 2-Mon., etc.

(3) Frequency - Columns 24-29

24-29	Month, day, and year of examination. Fill in later for sample persons seen at home prior to their visit to examination center.	Month 01-12 Day 01-31 Year 71, 72, etc.
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2. 24-hour dietary recall

A. Purpose

To obtain a record of the previous day's total food and beverage intake from midnight to midnight. Questions are asked also about use of vitamin and mineral supplements, salt intake, recent changes in diet and meals eaten away from home.

B. Obtaining and recording the 24-hour dietary recall

(1) Conducting the interview

After introducing yourself and seeing that the sample person is comfortably seated and at ease explain briefly the purpose and content of the dietary interview.

"As you know one of the reasons for this study (or the Health and Nutrition Examination Survey) is to learn more about the diets and nutrition of people in this country. The information you give me will become a part of information collected from a large group of people. I will ask you about how often you eat certain foods, I would also like you to tell me everything you ate or drank yesterday."

"Starting with the first thing you ate yesterday at midnight or after please tell me everything you ate or drank. I need to know how each food was prepared, for example, baked, fried, or boiled. Also I need to know about things like sugar in coffee, jelly on bread, and so forth. The amounts you ate are important, too, and I will show you models to help you show me how much you had."

Record foods as the respondent reports them. If he seems to have a difficult time beginning you may say:

"It may help you to remember what you ate if you think about what you did (\_\_\_\_\_ day.)"

"When did you first eat or drink anything after midnight on \_\_\_\_day?"

"What time did you get up yesterday?"

If the respondent is able to recall foods eaten it is a good plan to allow him to talk freely without interruption at the beginning. As he continues his recall you may relate his activities to possible food intake. For example, if he was at work in the morning, ask if he stopped for a break, and find out if he took any food or drink while on his break. If he went to the movies, ask if he had any refreshments before, during, or after the show. As time and places where foods are eaten are mentioned record in Time of Day and Food Source columns. All food items eaten at one time need not be listed consecutively, but the time and food source code must be repeated if items do not represent consecutive times and food source. Approximate times are sufficient.

Obtain information about the size or amount consumed. Food models generally are used to determine the size of portions eaten. Ask the respondent to relate the amount he ate to the appropriate food measurement model (spoon, glass, cup, mound, etc.). Although models are the preferred way to report amounts of food consumed, it is *possible* to record *any* food in grams. For details about proper use of models refer to section "Food Models and Their Use."

Information about brand names or the cost of individual items is helpful in determining amounts of candies, snack foods, drinks and the like. Sometimes the location of the food served is useful, for example, the carton of milk served at school is 8 oz. You may determine portion sizes of other items sold at local or chain-operated stores.

Often, it is easier to obtain portion sizes and details about preparation after the respondent has completed his recall of the previous day's intake; interruptions to check sizes or preparation method may cause the person to lose his train of thought.

Usually it is necessary to *probe* to get information about consumption of foods like butter, jelly, gravy, salad dressings, and some beverages. Ask "What else did you have at that time (or with that meal)?" "Was that (bread, vegetable, etc.) eaten plain or with something on it?"

When it appears that respondent has underreported a meal you may review what he states he has eaten to help "jog" his memory, as: "You had a slice of toast, tomato juice, and a fried egg for breakfast—did you have something else to eat or drink?" or "Did you put anything on the

toast?" "For lunch you had creamed chicken and peas—was there anything else on your plate?" *Do not suggest an answer* but try to *help* the respondent recall the details of all the food eaten the previous day.

(2) Recording the food intake

Do not skip lines when recording food items. If it is necessary to cancel or omit a line entry (for example, respondent corrects himself and states he ate beans instead of the green peas already recorded), draw a line through the entry to be omitted being sure the line goes through the columns headed "Ing. Per.," "Food Code," and "Line Card No."

Ingestion Period (column 36)

All four ingestion periods must be accounted for whether anything was consumed or not. If there is an ingestion period for which no food was consumed, record as shown on form below. If more than one between meal snack was eaten "3" may be coded as often as necessary. Total day-"5" will seldom be used, it refers to one or more food items prepared once and eaten throughout the day.

Ing. Per. (36)	Food Code (37 - 41)					Foods and Beverages Consumed		Work Area For Computations (If needed)	Size of Edible Portion Served			Time of Day (57 - 60)	Food Source Code (61)	Line Card No. (62 - 63)
						Food Item	Description		I (42 - 46)	II (47 - 51)	III (52 - 56)			
														01
2	0	9	9	9	9				1.	SKIPO				02
														03
														04

The ingestion period for meals is coded according to the descriptive information provided by the respondent rather than strictly by time-of-day food was eaten. Thus, if a respondent calls his 1 a.m. meal "Dinner" code it as ingestion period "4." If the food reported is not identified as a specific meal or snack, try to determine from the respondent what meal it represented or if it was a "snack" and code accordingly. Generally "1" refers to the breakfast meal, "2" to the noon meal and "4" to the evening, dinner, or main meal of the day.

The only *exception* to the above is when the 24-hour recall cannot be completed. When completion code "3," "4," "5," or "6" is used it is not necessary to account for all ingestion periods.

Food Code (columns 37-41)

At the completion of the interview insert the appropriate food code from the Food Code Book developed for HANES or USDA Handbook No. 8.

For assistance in coding new or unusual items the dietary coordinator checks with Headquarters Office, Nutrition Statistics Branch. New codes are added or code values modified only by the Headquarters Office.

Lead zeros are used when the food code has less than five digits.

#### Food Item and Description

Record in these columns the exact food or beverage consumption as reported by the sample person. Include as much identifying information as possible.

- (a) Name of item, including brand name if pertinent.
- (b) Description (raw, dry, frozen, edible portion or as purchased, size, and/or price of item.
- (c) Preparation method (fried, broiled).
- (d) Major ingredients, if a mixed dish for which no code available.

It is desirable to write each food item in a mixed dish on a separate line for ease in subsequent coding.

FOOD ITEM	DESCRIPTION	SIZE OF EDIBLE PORTION		
		I	II	III
Beef Stew	w/ Beef	1.5	H	
	Potatoes	1.	Unit	
	Peas	0.33	Z	
	Carrots	0.66	Z	
	Gravy	0.25	S	

#### Work Area for Computations (if needed)

Use the work area to enter any necessary information to describe the item and the probable amount if the specific amount cannot be entered in columns 42-56 immediately. For example, the food item is reported to be the size of  $\Sigma$  (a dimensional model) and additional calculations are needed to arrive at the weight - QR - Respondent cannot estimate size by one of the "acceptable models," necessitating additional later calculations. If the Greek letter models are used, they are always recorded here.

## Size of Edible Portion Served (columns 42-56)

These columns determine the basis on which the nutrient intakes are calculated. Determine from the respondent the size of the serving eaten by relating to the appropriate food measurement model.

### I (Columns 42-46)

These columns are to be used to record the number of units or part of a unit consumed. This is always a numeric entry. The numbers recorded here may be integers, decimal fractions, or mixed numbers.

Examples:	1.	(Integer)
	0.50	(Decimal fraction)
	1.50	(Mixed numbers)

Remember that:

All integers must be recorded with a trailing decimal. (1.)

All decimal fractions must be recorded with leading zero and decimal point clearly marked. (0.50)

### II (Columns 47-51)

These columns are used to record the model letter code or abbreviation code which describes the measure of the food item consumed. This is always an alphabetic entry. Greek letters may *not* be used.

The possible acceptable entries are:

#### MODEL CODES

A, S	(Cups)
B, V, Q	(Glasses)
SS, CC, M,E	(Spoons)
C, S, Z, J	(Mounds)
A, W, C, S	(Bottles/cans)
H, S, C, U, Y, SM, MED, LG	(Meats)
E	(Butter)
D, Q	(Pie)
E, M, G, H, CC, MM	(Discs)



## ABBREVIATION CODES

GM or GMS	gram
OZ	ounce
PT	pint
QT	quart
HFGAL	half gallon
LB	pound
CUP	cup
TBS	tablespoon
TSP	teaspoon
UNIT or UNITS	
SKIPO	

Do not use a period after the abbreviation.

Refer to section on "Food Models and Their Use" for further information about models.

### III (Columns 52-56)

These columns are used to modify the number of units or portion of a unit consumed which was recorded in I (Columns 42-46). Columns 52-56 are not used frequently.

Two arithmetic symbols are used to indicate the type of computation desired. "X" denotes multiplication; "/" division. The numbers which follow these symbols shall always be numerical entries—integers or decimal fractions; the rules for recording these numeric entries are the same as for I (Columns 42-46). Examples of modification:

- (a) Household serving to individual amount when models are not applicable. Respondent states she ate about 1/3 pint of ice cream. Record:

I	II	III
1.	PT	/3.

- (b) Meat or disc model thickness must be modified. For example, respondent indicates the thickness of the disc was the "4" on the ruler, record "X 4," in Columns 52-56. If meat eaten was one-fourth the thickness of the model record "X .25" in Columns 52-56.

- (c) Meat model represents bone and/or fat that was not eaten. Use figures to modify (correction factor) from "Yield of Edible Portion from Meat Cooked with Bone and/or Fat" (Section on Weights and Measures).
- (d) When Column III is used to modify the thickness of meat model *as well* as to correct for the bone and uneaten fat. Multiply the two correction factors to arrive at the factor to use.

*Example* Only the lean portion of a pork chop was eaten. Cooked chop covered 2/3 the surface area of model C and was 1/2 as thick as model.

*Calculation*

.49 is yield of lean meat from pork chop. 0.5 represents one-half the model thickness  $0.49 \times 0.5 = 0.245$ .

*Record*

I	II	III
0.66	C	X 0.25

Time of day (columns 57-60)

Times are recorded on 2400 hour day beginning with 0100 for 1 a.m. and ending with 2400 for midnight. Thus, 0930 is 9:30 a.m., 1200 is noon, and so forth. The approximate time each meal or snack was eaten is recorded. Time to the nearest one-half hour is satisfactory unless respondent reports it more precisely. When *Ingestion Period* is coded "5," *Time of Day should be coded "0001."*

Food source (column 61)

Usually information about the place where food was eaten is obtained as the respondent reports his food intake. If this is not the case inquire about it, for example, "was your breakfast eaten at home?" or "where did you have the coffee and cake in the afternoon?" "Home" is considered the food source for all food prepared and served at home; it also is the source of a packed lunch taken from home.

Ready-to-eat food brought into the home (as fried chicken, hamburgers, etc.) is coded according to the source, that is "Restaurant" or "Other."

"*Restaurant*" includes cafeterias and other self-service facilities, lunch counters as well as sit-down restaurants. "*Other*" includes food from vending machines, street vendors, or food eaten at homes of neighbors or relatives.

"School" includes any milk or any meal served in school room or cafeteria at school.

C. Additional Information - Columns 64-69

Column	Item and Explanation	Code
64	Relation of 24-hour intake to usual eating pattern. Determine significant changes in amounts or types of food eaten in recall period. Place or time of eating, number of meals or variation in activity should not be recorded, although such factors should be explored with respondent to determine if they have caused a different-from-usual amount of food to be reported.	1-Same pattern as usual Pattern of recall different from usual because: 2-Respondent ill 3-Respondent lacked money 4-Recall was for Sunday or holiday 5-Another reason
65	Recent changes in diet (within past year). <i>Prescribed Diet</i> —Diet received at clinic or doctor's office is coded "4" even if given and explained to respondent by a nurse.	0-No change 1-now eating more— 3-Now eating less 4-Now on diet prescribed by physician
66	Consumption of vitamin/mineral supplements.	0-Not eaten 1-Taken regularly 2-Taken irregularly
67	Type of supplement. To determine if vitamin and/or mineral product, ask respondent the brand name, color of tablets, and/or color of printing on the box. Interviewer may need to refer to guidelines to determine appropriate code. When available, write-in the brand name.	1-Multiple vitamins 2-Multiple vitamins and minerals 3-Iron only 4-Multiple vitamins & iron 5-Other (specify) 8-Not applicable (answer to question 66 is "NO")

68	Meals usually eaten in restaurants. This includes meals eaten in cafeterias, at lunch counters, drive-ins, etc. Code the number of times a week respondent usually eats a <i>meal</i> at such places. Between-meal snacks at restaurants are not counted.	0-Never, seldom 1-1 to 3 times 2-4 to 6 times 3-7 times or more
69	Use of salt at the table (respondents over age 20 only). Code the frequency with which salt shaker is used to season food after it has been served. Code "8" for respondents under age 20.	0-Rarely, never 1-Occasionally, seldom 2-Frequently, always 8-Not applicable

### 3. Food frequency

#### A. Purpose

To describe the pattern of use of selected foods and food groups within the past three months. If it is determined that the respondent's food intake has changed decidedly within 4-5 weeks of the interview (for example, he is on a newly prescribed diet for diabetes or weight control), the food frequency pattern should be based on his intake pattern prior to beginning the diet.

#### B. Obtaining and recording food frequency data

##### (1) Definitions

<i>Number of times</i> refers to <i>how often</i> the food item is eaten. When a range (as 3-4 times) is given use the lower figure. The <i>amount</i> eaten is not recorded. If two servings of vegetable, for example, are eaten at a meal, this constitutes one time.	Precoded Actual number 00-None 99-Unknown 77-Less than once weekly
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------

<i>Interval—Record</i> in the <i>one</i> appropriate box the codes to indicate the <i>number of times</i> the food item is eaten during a day or week.	0-None 1-Daily 2-Weekly 7-Less than once weekly 9-Unknown
--------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------

Note: If No. of times columns are coded 00, 77, or 99, one interval column must be coded respectively 0, 7, or 9.

Example

		Interval				
No. of Times		0	D1	W2	7	9
Eggs	0	5		2		

This indicates eggs are eaten 5 times a week.

(2) Recording the data

Food or Food Group	Explanation of Food Item
1. Milk	Includes only milk drunk as a beverage or used on cereal. Flavored milk drinks and cocoa made from milk are included. Include "1% milk" with skim milk; "2%" milk with whole milk.
2. Meat and poultry	All varieties of meat and poultry, including frankforts, luncheon meat.
3. Fish and shellfish	All varieties of fish and shellfish regardless of whether canned, fresh, frozen, or dried or salted.
4. Eggs	Includes eggs eaten as such, e.g., fried, boiled, poached, deviled, or egg salad. Does <i>not</i> include eggs in cooked or baked dishes (as custard, puddings).
5. Cheese and cheese dishes	Includes all types <i>except cream cheese</i> . Cheese eaten in sandwiches, salads, etc.
6. Dried beans and peas	All types dried beans and peas plus peanuts and peanut butter, eaten in any form.
7. Fruits and vegetables	(a) <i>All</i> fruits and vegetables regardless of method of preparation (raw, cooked, juice) or preservation (fresh, canned, frozen, dried).

(b) Fruits and vegetables from the total in (a) that provide 35 mgs. or more of vitamin C per average size portion appropriate to the item. Show the sample person the list of vitamin C-rich foods and read the list and amounts over with him.<sup>b</sup>

(c) Fruits and vegetables from the total in (a) that provide 2500 I.U. or more vitamin A per average size portion appropriate to the item. Show the sample person the list of vitamin A-rich foods and read the list and amounts over with him.<sup>b</sup>

8. Bread and cereals

(a) All types and varieties of bread, rolls, muffins, biscuits.

(b) Breakfast cereals-all types, cooked and ready-to-eat.

9. Butter and margarine

Includes all butter and margarine used on bread, toast, etc., as well as that used to season foods such as vegetables.

10. Desserts and sweets

Usual dessert items and/or "sweets," excluding candy.

11. Candy

All types of candy

12. Beverages

(a) Cold drinks sweetened with sugar. All types carbonated and plain, including drinks made from fruit-flavored dry mixes.

(b) Cold drinks without sugar or with a reduced sugar content. Same types as above.

(c) Coffee, tea.

13. Snack foods

Usual "snack items" as popcorn, salty crackers, chips, etc. In-between meals piece of fruit or cake is not "snack food."

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<sup>b</sup>To be counted, the amount of a vitamin A or C rich food eaten at a time must be at least as large as the serving noted on the list.

## Food Models and Their Use

For the Health and Nutrition Examination Survey, a computer will be used for determining the nutrient values of food consumed. The program for processing the data is adapted from a program developed at Tulane University and is based on a food composition table which includes the 2483 food items appearing in U.S. Department of Agriculture Handbook No. 8 (1963), Table No. 1, plus additional foods as needed to comply with those respondents report they consume. The food table (dietant) lists nutrients based on the amount of each nutrient in 100 grams of the specific food item.

### 1. Background

A. Food portion models are used by the dietary interviewers to secure from respondents the amounts of foods consumed. These models also were developed by nutritionists at Tulane University<sup>c</sup> and were designed so that the computer can take the alphabetic code assigned to each model, make necessary mathematical computations based on the size of the model and arrive at (1) the gram weight of a food consumed then, (2) the nutrients from the amount of food consumed. An over-simplified explanation of what will occur is demonstrated by the following example:

(1) A respondent may answer: "I ate applesauce in the amount of twice model 'S' yesterday."

(a) The interviewer will record as follows:

Food Code (37-41)	Food Item	Columns (42-46)	Columns (47-51)
	Applesauce	2.	S

(b) The computer will automatically know the gram weight of applesauce based on the food code numbers recorded in Columns 37-41, understand that model "S" refers to 3/4 cup and make necessary calculations.

(2) The respondent may have answered: "I consumed spaghetti in the amount of twice model 'S' yesterday."

(a) The interviewer will record as follows:

Food Code (37-41)	Food Item	Columns (42-46)	Columns (47-51)
	Spaghetti	2.	S

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<sup>c</sup>Moore, M C et al Using Graduated Food Models in Taking Dietary Histories J.A.D.A. 51:447-450, 1967

- (b) The computer's automatic calculations know that the gram weight and nutrient values for spaghetti are different from applesauce since the food code number is different. It will then make necessary calculations to get nutrient values for this different item although *measured* with same model.

Thus THE CORRECT USE OF THESE MODELS WILL ELIMINATE THE TEDIOUS, TIME-CONSUMING procedures of converting each household measure to the correct gram weight of the food consumed.

## 2. Description of food models

It is important to understand that the models are not intended to be models of any one food. Rather, they are models designed to *assess portion size*.

These are the models and their alphabetic code that you will find in the kit:

Model	Type Measure	Alphabetic Code	Numeric Equivalent	Approximate Household Measurement Equivalent
Cups	Cup	A	10.00	1 1/4 cups
		S	06.00	3/4 cup
Glasses	Cup	B	11.00	1 3/8 cups
		V	09.00	1 1/8 cups
		Q	05.00	5/8 cup
Spoons	Cup	SS	00.70	1 1/2 TBS
		CC	00.50	1 TBS
		M	00.30	1/2 TBS
		E	00.20	1 TSP
Mounds	Cup	C	16.00	2 cups
		S	06.00	3/4 cup
		Z	02.50	1/3 cup
		J	14.00	1 3/4 cups
Bottles/cans	Cup	A	10.00	1 1/4 cups
		W	12.00	1 1/2 cups
		C	16.00	2 cups
		S	06.00	3/4 cup
Meats	Weight	H	01.50	1 1/2 oz
		S	06.00	6 oz
		C	16.00	1 lb
		U	31.00	2 lb
		SM	01.00	1 oz
		MED	02.50	2 1/2 oz
		LG	05.00	5 oz
		Y	03.00	3 oz



Model	Type Measure	Alphabetic Code	Numeric Equivalent	Approximate Household Measurement Equivalent
French Bread	Unit	UNIT		34 gms
Butter/ margarine	Weight(pat)	E	00.20	1/5 oz
Pie	Weight	D	04.00	4 oz
		Q	05.00	5 oz
Discs and Squares	Weight	E	00.20	1/5 oz
		M	00.30	1/3 oz
		CC	00.50	1/2 oz
		MM	00.60	2/3 oz
		G	01.00	1 oz
	H	01.50	1 1/2 oz	
Boxes	Dimension	$\pi$ 20.4 cubic in. (1 3/4" x 2 3/4" x 4 1/4") $\Sigma$ 6.25 cubic in. (2 1/2" x 2 1/2" x 1") $\Delta$ 15.9 cubic in. (1/10 of 10" circle 3 1/4" high)		

The numeric equivalent indicates the MEASURE (*either weight or volume*) depending upon the food item. If the model's equivalent is 10.00, and this is a weight measure food item, the equivalent is interpreted by the computer to mean 10 ounces. On the other hand, if this is a cup measure food item, the computer would interpret the numeric equivalent of 10.00 to mean 1 1/4 cups. (10.00 x 1/8 cup.)

An alphabetic code letter is used on more than one type of model. For example, the code letter "S" appears on a cup and also on fish. This is because the numeric equivalents are the same—the fish model is 06.00 indicating 6 ounces while the cup model is 06.00, but this would indicate 3/4 cup. (06.00 x 1/8 cup.)

### 3. Use of models

A. It is necessary that data be recorded in a specific and consistent way. Therefore, each interviewer must be thoroughly familiar with the portion size models and the appropriate method of using them. The Food Code Book developed for use in HANES indicates the preferred model(s) for recording each food item. Also, a Guide for Using Food Models is available. This guide indicates the preferred model (which is generally the manner in which that food item is measured) and alternates. It also indicates which models cannot be used for each food group. Improper recording of food models can result in either gross over or under-estimation of nutrient intake. Use of incorrect models slows down computer processing as the computer will reject items coded incorrectly.

Three basic principles:

- (1) Food items which generally are recorded by a *weight* measure are recorded by models and measures based on *1 ounce (28 grams)*. This is referred to as a WEIGHT MEASUREMENT. No other method of recording may be used for recording these items.
  - (2) Food items which generally are recorded by a *volume* measure are recorded by models and measures based on weight of 1/8 cup of the specific food. This is referred to as a CUP MEASUREMENT. No other method of recording may be used for recording these items.
  - (3) Food items which generally are recorded by a "*unit*" (examples: 1 apple, or 1 banana, or 1 egg) are based on a reference weight for the unit. This is referred to as a UNIT MEASUREMENT. No other method of recording may be used for recording these items.
- B. The models should be taken from the desk drawer or suitcase at the time portion size is being determined (rather than being spread out ahead of time), Give the respondent a choice of all appropriate models each time, with the *models being arranged from the smallest to the largest* in a row. For example, if he says he ate a "bowl of stew" he would be shown all bean mound models—Z, S, J,—so that he could choose the size that most nearly corresponds to the amount he ate. Use either the bean or rice models when a mound model is selected. Generally the choice is dictated by the type of food being considered—rice models for light-colored foods such as cereal, ice cream, or canned fruits; bean models for foods such as stews, soups, and most vegetables.
- C. The reported intake will not always correspond to the exact size of the model.
- (1) Special symbols can be used whenever the respondent uses two models to describe the size serving. The symbols are as follows:

SYMBOL	DEFINITION	USE
=	(range)	Respondent states the serving size is between two models.
+	(add)	Respondent ate the equivalent of two models.
-	(subtract)	Respondent served one model, had the equivalent of another model leftover.

When using these special conditions, the *smaller* model must be recorded to the *left* of the sign.

Examples: (Refer to kit to note sizes of two models.)

$$S = A$$

$$S - A$$

$$S + A$$

- (2) Glasses (B, V, Q). Marks are placed at the  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$  volume level. These marks must be used to indicate the amount consumed if it is less than the top mark. The top mark shows the full volume of the glass as it is considered by the computer. Example: Glass Model B at the full level *mark* is  $1 \frac{3}{8}$  cups, if "filled to the brim" it would be more than "1B."
- (3) Meat (C, U). Lines appear on the sides of these models. They represent 0.25, 0.50, 0.75 and all of the thickness. These lines will be needed should the respondent state amount consumed was different thickness from the model.

Use of the meat models needs special attention as the weight equivalent of these models may represent the weight of meat plus bone and/or fat. When using the meat models it is essential to determine if the model selected by the respondent represents bone and fat as well as meat. Then, the interviewer must determine if some or all of the fat was eaten. The appropriate factor is then applied (columns 52-56) so that the computer will correct for the bone and fat or for the bone only if the fat was consumed.

- (4) Thickness models are to assist with dimensions or with thickness of disc, square and rectangular models. Each thickness model is  $\frac{1}{8}$ " thick, which is the thickness on which the disc is based. Note that  $\frac{1}{8}$ " thickness is marked "1;" 2 units equal " $\frac{1}{4}$ " and would be recorded as "2." Always record the number on the top thickness model if several are stacked together to arrive at the thickness of food consumed.

D. Boxes - Greek letter code. These models are for use in estimating dimension and subsequently weight of those items so indicated in the Guide for Use of Food Models.

At the completion of the interview the gram weight of edible portion must be determined if a Greek letter box was used during the interview to describe the amount eaten. Note the example:

Respondent eats a piece of pound cake one-half the size of model marked  $\pi$ .

Step one : Arrive at the total number cubic inches consumed. Since  $\pi \approx 20.44$  cu. in., one-half that size would mean the piece of pound cake was the equivalent of 10.22 cu. in.

Step two : Secure gram weight for a specific size of the food item. By referring to a standard reference such as USDA Bulletin No. 72, it may be noted that a piece of pound cake  $3\frac{1}{2}'' \times 3'' \times \frac{1}{2}''$  (5.25 cu. in.) weighs 30 gm.

Step three: Calculate grams for cubic inch.

$$\left( \frac{1 \text{ cu in.} = \text{number of gms.}}{\text{number of cu. in.}} \right)$$

If 5.25 cubic inches weighs 30 grams, 1 cubic inch weighs 5.7 gm (30 / 5.25)

Step four: Calculate gram weight of item consumed. Thus, the piece of pound cake consumed which was 10.22 cubic inches, would weigh 58 gm. (10.22 cu. in. x 5.7 gm. per cu in. rounded to the nearest whole number.)

Step five : Transfer to proper columns.

Cols.	Cols.
(42-46)	(47-51)
58.	GMS

## CHAPTER 7

### DENTAL EXAMINATION

#### Equipment

Dental engine and rheostat  
Dental handpiece, designed for biopsy  
Felt cones with blunted ends  
Cotton pellets, specially prepared  
Deionized water  
Cotton rolls  
Tape, specially prepared  
2"x2" gauze  
Abrasive slurry, specially prepared  
Syringe, for water  
Air syringe  
Hemostats  
Forceps  
Plastic tubes  
Spoon excavator

#### General

The dental examination findings are recorded on a form which eliminates the time-consuming task of coding and key punching. The form, four pages bound at the left-hand margin, will be fed into the Optical Mark Page Reader which will read the findings and enter the data directly on IBM cards. Pencil marks in specific positions on the page represent the various coded findings. A marking position (the space between two short lines) is filled in with a pencil *not a pen*. The code letters and numbers for each marking position are printed on the form.

Premarked stand and control numbers are included to simplify the matching of pages. Only the examinee number is marked by the recorder. One thousand forms are available for each stand and should be used in sequence. Forms 901-999 will be used for dental replicates.

#### Procedure

1. *Examinee number*.—Mark the sample number and print the name in the areas provided on the form.
2. *Age* (at last birthday).—Mark in the space provided.
3. *Race-Sex*.—Mark in the space provided.
4. *Status of tooth spaces*.—The condition of tooth spaces is determined in accordance with the following criteria. Circumstances which may prevent a reasonable application of the criteria should be explained under "Re-

marks." If primary teeth are present, code each one (D) and also code the status. This requires putting a mark in the "D" space and a mark in the appropriate space indicating the status of the tooth. If permanent teeth are present, code only their status.

*Normal.*—Code unfilled teeth without carious lesions as (3). If they are primary teeth, also code (D).

*Carious.*—Code unfilled teeth with carious lesions according to the surface(s) involved. If they are primary teeth, also code (D).

Initially each tooth is examined visually for decalcified areas, opacities of marginal ridges, and undermined enamel in pits and fissures. Once observed, suspected lesions are considered carious only when a break in the enamel can be demonstrated with an explorer.

4x=occlusal or incisal  
40=lingual  
41=buccal or labial  
42=mesial  
43=distal

*Filled (including crown).*—Code teeth satisfactory fillings and no carious lesions according to the surface(s) involved. If they are primary teeth also code (D).

5x=occlusal or incisal  
50=lingual  
51=buccal or labial  
52=mesial  
53=distal

*Filled defective (or tooth both filled and carious).*—Code filled or crowned teeth with new or recurrent carious lesions according to the surface(s) involved. If they are primary teeth also code (D). Noncarious filled teeth are indicated in like manner when the restoration is loose or when it is fractured and the base or pulpal wall of the cavity preparation is exposed. Teeth with temporary fillings or crowns are coded as filled defective.

6x=occlusal or incisal  
60=lingual  
61=buccal or labial  
62=mesial  
63=distal

*Nonfunctional-carious.*—When decay has penetrated the pulp chamber of a tooth, code the tooth as (XD). If the tooth is primary, also code (D). Carious teeth are nonfunctional when there is:

- A. Visible evidence of periapical abscess or pulpal exposure.
- B. Visible evidence of extensive undermining of all enamel walls or if roots only are remaining.

*Retained deciduous teeth.*—When any portion of the succedaneous tooth can be seen, give it an appropriate status code under teeth present; and code the deciduous tooth (XD) and (D).

*Missing teeth (unerupted, extracted, and replaced).*—When neither a primary nor a permanent tooth is present (the tooth space may be vacant or the missing tooth may be replaced by a fixed or removable partial denture) record a code indicating the status of the tooth space. For persons 35 or under, the reason for the missing tooth should be determined. When in doubt score it as 1R.

2=Unerupted, primary

0=Unerupted, permanent

1R=Extracted, caries

①=Extracted, accident, orthodontics, impaction

Note: Special effort should be taken to insure that missing third molars are correctly coded. When there is any doubt, ask if any "back teeth" have been extracted and follow with other appropriate questions to determine the code for missing molars—unerupted, extracted, impaction, early eruption with mesial drifting, and so forth.

F=Missing, replaced on a fixed bridge. In this instance also code the reason for extraction.

FD=Missing, replaced on a defective fixed bridge. In this instance also code the reason for extraction.

Fixed bridges are defective:

- A. When one of the abutment teeth is nonfunctional due either to caries or loss of supporting structure or when there is visible evidence of periapical pathology.
- B. When the connection of the pontic with its abutment is broken.
- C. When an abutment crown or inlay is defective due to one of the following reasons:
  - 1. The tooth structures exposed by abrasion of the crown or inlay is carious.
  - 2. A carious lesion at one of the margins of the restoration has resulted in extensive undermining of an enamel wall.

R=Missing, replaced on a removable partial denture. In this instance, also code the reason for extraction.

RD=Missing, replaced on a defective removable partial denture. In this instance, also code the reason for extraction.

Removable partial dentures are defective:

- A. When an abutment tooth is nonfunctional due either to caries or loss of supporting structure or when there is visible evidence of periapical pathology.
  - B. When there is visible evidence that the denture is causing extensive destruction of the stress-bearing areas of the ridge or palate.
5. *Periodontal Index*.—Record positive findings under columns headed 1, 2, 6, and 8. Score a tooth space X if a tooth is missing or only the root is present. Do not record scores for teeth on which there are no positive findings. If no positive scores are recorded at all, mark "no P.I."

Blank=Negative

There is neither overt inflammation in the investing tissues nor loss of function due to destruction of supporting tissues.

1. *Mild gingivitis*.—There is an overt area of inflammation in the free gingivae, but the area does not circumscribe the tooth.
2. *Gingivitis*.—Inflammation completely circumscribes the tooth, but there is no apparent break in the epithelial attachment.
6. *Gingivitis with pocket formation*.—The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice due to swelling in the free gingivae). There is no interference with normal masticatory function; the tooth is firm in its socket and has not drifted.
8. *Advanced destruction with loss of masticatory function*.—The tooth may be loose, may have drifted, may sound dull on percussion with a metallic instrument; may be depressible in its socket.

RULE: When in doubt assign the lesser score.

6. *Oral Hygiene Index*.—Selected surfaces of six teeth are used in making this estimation of oral hygiene status. For the purposes of this examination, each surface that is used, buccal or lingual, is considered to encompass half of the circumference of the tooth. The buccal surface of a molar, for example, is considered to include half of the mesial surface and half of the distal.



The posterior teeth used for the assessment are the first fully erupted teeth distal to the bicuspid area on each side of the arch. In most cases these will be first molars, but sometimes they may be second or third molars. If none of these teeth are present, mark the "not applicable" (NA) space. Examine the buccal surfaces of upper molars and the lingual of lowers.

In the anterior portion of the mouth, examine the labial surfaces of the upper right central incisor and the lower left central incisor. When these teeth are missing, only the adjacent central incisor can be substituted; otherwise, mark the "not applicable" (NA) space.

A. *Examining for oral debris.*—The surface area covered by debris is estimated by running a shepherd's hook explorer along the surface being examined and noting the occlusal or incisal height of the debris as it builds up on the explorer.

0=No debris or stain present.

1=Soft debris covering not more than the gingival third of the tooth surface, or the presence of extrinsic stains without debris regardless of surface area covered.

2=Soft debris covering more than one-third but not more than two-thirds of the exposed tooth surface.

3=Soft debris covering more than two-thirds of the exposed tooth surface.

NA=Not scored; missing teeth, partially erupted teeth, badly decayed teeth with loss of anatomy, or teeth with orthodontic bands.

B. *Examining for oral calculus.*—The explorer is also used to estimate the surface area covered by supragingival calculus and to probe for subgingival calculus.

0=No calculus present.

1=Supragingival calculus covering not more than one-third of the exposed tooth surface.

2=Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface, or when individual flecks of subgingival calculus are present around the cervical portion of the tooth.

3=Supragingival calculus covering more than two-thirds of the exposed tooth surface or a continuous *heavy* band of subgingival calculus around the cervical portion of the tooth.

NA=Not scored; missing teeth, partially erupted teeth, badly decayed teeth with loss of anatomy, or teeth with orthodontic bands.

7. *Opacities*.—When fewer than two of the eight upper permanent teeth are present (first bicuspid to first bicuspid inclusive) and free of orthodontic bands mark the "not applicable " (NA) space and give no rating for non-fluoride opacities or fluorosis.

A. *Nonfluoride opacities*.—These lesions are often round or oval. They are clearly differentiated from adjacent normal enamel. They are usually pigmented, often creamy-yellow to dark reddish-orange. Any tooth may be affected. They do not follow a standard pattern of distribution. Mark the appropriate space using the following criteria:

*None*.—Fewer than two of the eight upper anterior teeth are affected.

*Mild*.—Two or more of the eight teeth are affected, but the areas cover less than half of the labial surface.

*Moderate-severe*.—At least half of the labial surface of two or more of the eight teeth are affected.

B. *Fluorosis*.—In the space provided, mark one of the following three classifications:

*None*.—The enamel presents the usual translucent and semivitriform type of structure. The surface is smooth, glossy and usually of a pale, creamy-white color.

*Mild*.—At least two of the eight upper anterior teeth have small, opaque, paper-white areas scattered irregularly over them but the areas do not involve as much as approximately 50 percent of the labial surface.

*Moderate-severe*.—Half or more of the labial surfaces of at least two of the eight teeth are affected, and surfaces subject to attrition show marked wear. Brown stain is frequently a disfiguring feature. There may be discrete or confluent pitting.

8. *Orthodontic appliances*.—If an orthodontic appliance is present mark the category that best describes the appliance. If no appliance is present, mark "None."

9. *Other conditions*.—Mark "Yes" when the following criteria are met.

A. *Bleeding gums*.—There is a diffuse, marginal inflammation of the gums; the papillae and gums may be swollen; bleeding is spontaneous and apparently not associated with a faulty filling or denture.

B. *Diffuse marginal inflammation*.—There is definite inflammation of the marginal gingiva surrounding at least half of the teeth. The inflammation is not associated with a dental appliance.

- C. *Swollen red papillae*.—The papillae are inflamed and swollen, giving a spongy appearance. The papillae of at least half of the teeth present are involved. The inflammation cannot be attributed to a faulty appliance.
- D. *Recession*.—The alveolar process in the anterior region of the mandible may be noticeably resorbed. When little or no alveolar resorption has occurred, the embrasures between at least four of the lower anterior teeth are no longer filled by the papillae, thus exposing the lateral aspect of the cemento-enamel junction. With more advanced recession, the cemento-enamel junction at the labial as well as the lingual aspects of the teeth may also be seen. When marked alveolar resorption has taken place, the labial and lingual halves of the papillae may be separated and the gingiva retracted from the tooth surfaces.

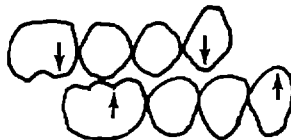
10. *Serviceable Posterior Teeth*.—Indicate whether four or more pairs of opposing serviceable posterior teeth are "present" or "absent." Include artificial teeth in the count if they are satisfactory replacements.
11. *Buccal segment relation*.—This assessment describes the anterior-posterior position of the teeth in the lower arch in relation to the teeth in the upper arch. Most often, the score is based on the relationship of the upper and lower first permanent molars. When the permanent molars are missing, have not erupted to occlusion, or have lost their anatomy from caries or fillings, primary molars or the permanent cuspids and bicuspid are used to assess the buccal segment relation. For assessment purposes, the upper cuspid can be regarded as the mesiobuccal cusp of the lower first molar.

With the teeth in occlusion assess each side of the mouth individually and mark the appropriate space. To assure a right-angle view of the area, the mouth mirror should be used. The schematic drawings which follow will serve as a guide.

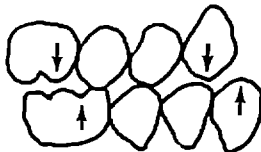
A. Permanent arch.—

Buccal Aspect-Right side

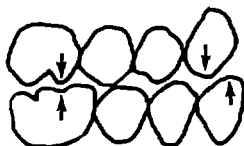
- (1) Mesial Severe. A mesial positioning of the lower molar beyond cusp-to-cusp deviation.



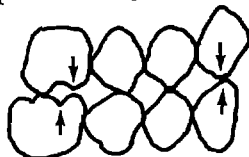
- (2) Mesial Moderate. A mesial positioning of the lower molar up to and including a cusp-to-cusp relation.



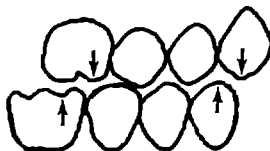
(3) Normal. Mesio Buccal cusp of upper in buccal groove of lower.



(4) Distal Moderate. A distal positioning of the lower molar up to and including a cusp-to-cusp relation.

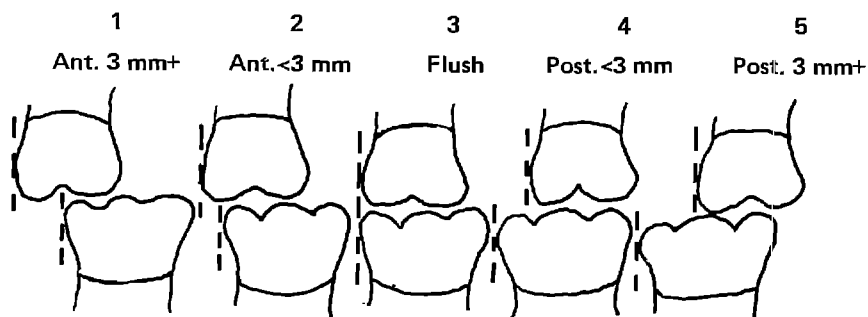


(5) Distal Severe. A distal positioning of the lower molar beyond a cusp-to-cusp deviation.



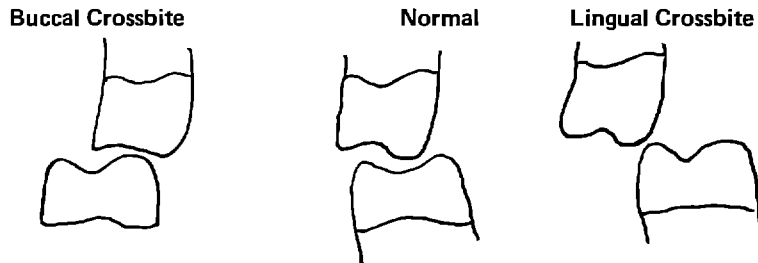
B. Primary arch.—The score is given according to the position of the distal surface of the lower primary second molar in relation to the distal surface of the upper primary second molar. The schematic drawings which follow will serve as a scoring guide. Also mark "Primary Arch."

Buccal Aspect-Right side



- Primary 1. Lower is anterior to upper by 3 mm. or more.
- Primary 2. Lower is anterior to upper by less than 3 mm.
- Primary 3. Lower is flush with upper.
- Primary 4. Lower is posterior to upper by less than 3 mm.
- Primary 5. Lower is posterior to upper by 3 mm. or more.

12. *Posterior crossbite*.—This is a measure of buccal-lingual deviation in the posterior segment (bicuspid and molars). Include both primary and permanent teeth in the appraisal. To simplify the procedure, assume that it is the upper tooth that has deviated. The deviation must involve the whole tooth (not just a rotation) and must be a deviation to or beyond a cusp-to-cusp relation (see drawings below). The scores are counts of the upper teeth in buccal crossbite and in lingual crossbite on each side of the arch. Mark the four totals in the appropriate spaces.



13. *HLD index*.—At least one upper and one lower permanent central must be present and fully erupted for this assessment. Otherwise, mark the "not applicable" (NA) spaces.

A. *Overjet-mandibular protrusion*.—With the teeth in occlusion measure with a Boley gauge the distance from the most anterior labial surface of a lower permanent incisor to the most anterior labial surface of an upper incisor. Hold the instrument parallel to both the occlusal and the midsagittal planes. Record the measurement (to the nearest whole millimeter) by marking the appropriate space in either the "Overjet" box (for upper protrusion) or the "Mandibular Protrusion" box (for lower protrusion). Since the two measurements are mutually exclusive, "NA" should be marked for the one not measured. Report an edge-to-edge bite as "NA" for "Overjet," "zero-zero" for "Mandibular Protrusion," "3" for "Incisor Relationship," "NA" for "Overbite," and "zero-zero" for "Openbite."

B. *Overbite-Openbite*.—The measurement, in millimeters, of the vertical overlap of the incisal edges (overbite) or the vertical space between incisal edges (openbite) is also made with a Boley gauge. When overlapping is present, make a pencil mark on the lower right or left permanent central incisor indicating the vertical position of the incisal edge of the corresponding upper incisor. Measure the distance from the incisal edge to the pencil line and record it (to the nearest whole millimeter) by marking the appropriate space in the "Overbite" box.

When mandibular protrusion is accompanied by anterior crossbite, mark "NA" for "Openbite," for "Overbite," and for "Incisor Relationship."

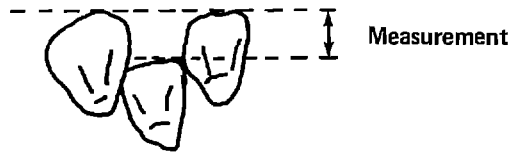
When unusual measurements for overjet, mandibular protrusion, edge-to-edge bite, or anterior crossbite are the result of several rotated or displaced anterior teeth, the examiner should select the set of measurements and codes which expresses best the vertical and horizontal incisor relationships. Describe the condition under "Remarks."

- C. *Incisor Relationship*.—This assessment is made in conjunction with the overbite-openbite measurement of the HLD index on permanent teeth. When mandibular protrusion is measured in HLD the applicable score should be marked for vertical incisor relationships.

The code number should be marked in the category which describes the location of the line on the lower incisor (the incisal third, 0-1/3; the middle third, 1/3-2/3; the gingival third, 2/3-3/3). If the line would appear on tissue below the gingival margin of the lower incisor or if the lower incisors are in contact with the soft tissue of the palate (Impinging Overbite), code as (Tissue) or (Impinging Overbite), respectively.

If an openbite is present (no mark on the lower incisor) the code number 1, 2, or 3 should be marked whichever corresponds to the measurement recorded in openbite.

- D. *Labiolingual spread*.—To measure labiolingual spread, use the Boley gauge to determine the extent of deviation from a normal arch, of teeth locked out of the normal arch line (inadequate space available in the arch). Only the six upper and lower permanent anterior teeth are assessed. In the illustration below the measurement is made from a line passing through the incisal edge of the mandibular left cuspid and central to the incisal edge of the lingually locked lateral incisor. When there is only a protruded or lingually displaced anterior, make the measurement from the incisal edge of that tooth to the normal arch line. When two teeth are locked out of an arch, measure the total distance between the protruded and the lingually displaced anteriors. Sum the measurements from both arches, round to the nearest whole millimeter, and mark in the labiolingual spread area.



E. *Deformity*.—Make a check in the "Present" space when you observe a cleft lip or palate repaired or unrepaired or other severe traumatic deviation resulting from burns, other accidents, or other gross pathology. The deformity should be described in "Remarks." When no deformity is present, mark the absent space.

14. *Malaligned teeth*.—Count the number of teeth rotated nearly 45° or displaced about 2 millimeters from their ideal alignment. Then count the number of teeth rotated *more* than 45° or displaced *more* than 2 millimeters from the ideal. In the upper arch, count malaligned anterior teeth (including cuspids) before malaligned posterior teeth. Repeat the procedure for the lower arch. Mark the totals for each segment in the appropriate spaces according to whether they are minor ( $\leq 45^\circ$  or  $\leq 2$  mm.) or major ( $> 45^\circ$  or  $> 2$  mm.) malalignments.

15. *Edentulous arches-denture status*.—No entry is made in this section unless at least one arch is edentulous. An arch with erupted or partly erupted teeth is considered edentulous if a full denture is used.

*Absent*.—No teeth (or roots) are present in the arch and the examinee does not have a denture either in the mouth or on his person at the time of examination.

*Present*.—Denture is present in the mouth and not defective at the time of examination.

*Defective*.—There is visible evidence that the denture is causing extensive destruction of the primary stress-bearing areas of the ridge or palate. Tissue in these areas may be acutely inflamed; bone resorption may have occurred; hypertrophied tissue may be present. The denture is also defective if it is in the possession of the examinee at the time of the examination but not in the mouth.

If a denture status code for either or both arches is marked, the following should also be true:

- A. The spaces for the appropriate arch (or arches) under Status of Tooth Spaces, Periodontal Index, and Malaligned Teeth should be left blank.
- B. The "NA" spaces for the appropriate arch (or arches) under OHI should be marked
- C. The "NA" spaces under Opacities, Buccal Segment Relation, Posterior Crossbite, Incisor Relationship, and HLD index should be marked.

Ask the two questions about the use of dentures when eating.

16. *Remarks.*—Mark "Present" when comments are written in this area; mark "Absent" when no comments are written.

Report any pertinent information about the examinee's dental health not covered by the procedures in the examination.

List by number teeth with orthodontic bands.

Describe any deformities.

If a situation is encountered for which codes are not described in the examination procedure, leave the uncodeable item blank so that it will fail to pass computer edit. Describe the situation in detail under "Remarks."

17. *Interview.*—These questions should be asked at the very beginning of the dental examination. An appropriate lead into the questions would be a reference to our interest in nutrition and an individual's ability to bite and chew food. Record the responses in the spaces provided.

18. *Treatment Needs.*—This estimate will be based on the examiner's clinical judgment. However, certain factors should be kept in mind when deciding if missing teeth should be replaced and if all remaining teeth in an arch should be extracted and a full denture constructed. Consider, in addition to the status of oral hygiene and periodontal disease in the mouth, the age of the examinee, the responses to the questions about chewing and eating, and the probable benefit to the individual's health and nutrition.

Report "yes" or "no" for each area of need. Record counts of the numbers of fillings and extractions needed when appropriate, and indicate the teeth to be replaced by fixed bridges or partial dentures. The type of denture should be marked in the area provided for repair, relines, and construction of denture.

19. *Enamel Biopsy.*—An enamel biopsy should be taken from all persons with a permanent upper incisor present with sufficient area on the labial surface, free of fillings, for the window in the plastic tape used to isolate the biopsy location. Always choose central incisors before lateral incisors. For even-numbered sample persons, choose a right tooth; for odd-numbered sample persons, choose a left tooth.

A. *Procedure*

- (1) Assemble within easy reach of the working area all the necessary materials for doing the enamel biopsy.
- (2) Wipe vigorously the tooth to be biopsied with a 2"x2" gauze to remove any debris.



- (3) Isolate the tooth by placing cotton rolls under the upper lip.
- (4) Dry the tooth with the air syringe.
- (5) Place tape on the tooth to be biopsied with the "hole" near the center of the tooth; secure the tape using finger pressure.
- (6) Wipe the exposed surface with a 2" x 2" gauze to remove any impurities left by your fingers.
- (7) Using a spoon excavator to carry the abrasive to the exposed surface, cover the surface with a thin layer of abrasive.
- (8) Start the dental engine and adjust the speed so that the hand piece is turning at a rate of 800 RPM. (This number of RPM's can be judged by counting the number of revolutions of a mark placed on the engine belt—when 1 belt revolution occurs in 3 seconds the handpiece is turning at the correct speed.)
- (9) Attach the felt cone to the hand piece and moisten the cone with a drop of deionized water.
- (10) Apply the revolving felt cone to the abrasive material and apply proper pressure. All angles formed by the triple arm, and the angle formed between the felt cone and the tooth should be close to 90°.
- (11) Have the assistant start the 60 second timing. The assistant should also check the revolution of the belt and make any necessary adjustments.
- (12) The assistant should inform you when 50 seconds have passed and should begin a 5 second countdown when 55 seconds have passed.
- (13) At the end of 60 seconds remove the felt cone from the tooth surface and have the assistant remove the felt cone from the hand piece and using the hemostat place it in the labeled plastic tube.
- (14) Using the specially prepared cotton pellets (moistened with a drop of the deionized water) held with the forceps, wipe the slurry from the abraded area; and place this pellet and any additional pellets used in the same tube as the felt cone.
- (15) Remove the tape from the tooth; and wipe up any additional abrasive slurry with cotton pellets; and place these pellets (if used) into the plastic tube.
- (16) Remove the cotton rolls from under the examinee's lip.
- (17) Record the tooth number and the examinee's sample number.

B. *General Considerations*

- (1) Try not to use more than 2 cotton pellets.
- (2) Never touch the felt cones or cotton pellets with your fingers.
- (3) Keep the time, pressure, and angulation constant.

C. *Shipping the Biopsies*

- (1) Once every two weeks, pack the biopsies for shipment.
- (2) Make a list of the biopsies by sample number and tooth biopsied.

- (3) Send the biopsies and the list (under separate cover) every two weeks to:

Dr. James R. Mellberg  
Kendall Research Center  
411 Lake Zurich Road  
P.O. Box 476  
Barrington, Illinois 60010

### Report of Findings

Before the dental examination remove the Report of Findings form from the case record.

Complete the report using your best judgment about findings which should be called to the attention of the family dentist. If a condition found during the examination requires immediate attention, telephone the family dentist or tell the examinee (or call his parents) if no dentist is listed. A brief report of the call should be included in the case record on the control sheet.

If the name and address of a dentist or clinic has been entered on the form, complete the form at the end of the examination and mail it in one of the window envelopes provided.

Tell the examinee briefly about the status of his dental health at the end of the dental examination (especially those who have not given a name of a dentist or clinic), but clearly state that without X-rays or a followup examination the survey exam should not be considered a substitute for a regular dental checkup. The survey examination identifies only items which should be further evaluated clinically.

## CHAPTER 8

### DERMATOLOGICAL EXAMINATION

#### EQUIPMENT

Isopropyl alcohol  
Steri-Drapes  
Sterile gloves  
25 gauge disposable needles  
Xylocaine 2% with epinephrine  
Xylocaine 2% without epinephrine  
Disposable sterile punches  
Scalpel handle and blades  
Needle holder  
Corrugated forceps  
4.0 and 6.0 silk sutures  
Scissors  
Gelfoam sponges  
Monsel solution  
Surgical tape  
Cidex aqueous  
Formaldehyde  
Specimen bottle  
Mailing containers  
Frosted glass slides  
Potassium hydroxide  
Alcohol burner  
Nikon camera  
Film  
Wood's lamp

#### General

The dermatological examination for HANES is a complete clinical examination of the skin and its appendages which considers normal variations in texture and color, certain manifestations of aging, and all pathological changes documenting significant diagnoses by biopsy or culture whenever possible. Estimates are made of actinic exposure experienced as well as actinic damage sustained, and of occupational risk from irritant and allergic contractants. For an examinee with a significant hand, foot, or generalized problem a judgment is made about the burden to the examinee in terms of discomfort or disability, about the care sought, and about the effect expected from current best care.

The form is so designed that some normal findings will require that no mark be made. For example, in "3. Skin Texture," a person with skin neither oily nor dry, neither fine nor coarse, etc., could have no box checked. On the other hand,

some observations will be made on everyone; eye color is a good example. In general when an area examined has no normal variation or pathology to record, a box marked "No findings" must be checked.

The complete form is divided into five major parts. The first gives the individual's identifying information, the examiner's number, and sums the major dermatological findings and procedures. The second provides space for information about the skin generally—color, texture, ectodermal appendages, vascular lesions, pigmented nevi, and in fact many of the pathological changes that occur in a generalized fashion—purpura or seborrheic keratoses, even warts. The third part is for regional examinations, findings that may be peculiar to the head or neck such as xanthelasma, cheilosis, or scrotal tongue. Part four is for disease-oriented information—acne, psoriasis, and atopy, etc., in an effort to have a little more detail on these common problems. The last part is perhaps most unique and is an effort to evaluate the impact of the dermatological condition observed—how it has modified an individual's life through physical or psychic incapacitation, and how it may have precluded a preferred activity. An estimation is to be made by the examiner of the degree of disfigurement the condition has produced as well as the symptomatology the examinee has suffered. For this purpose we are grouping all hand problems, then foot problems, then problems other than those primarily hand or foot. It might be a generalized problem such as vitiligo or exfoliative erythroderma. An effort is made to identify the care the examinee has sought for the problem, whether in the opinion of the examiner it has been adequate and if not, why not. Has it been a matter of ignorance, whether on the part of the examinee or his physician? Has it been a problem of finance or inconvenience in travel, or perhaps the unavailability of care at any price or distance? The examiner is asked to judge if the current best care would improve the examinee's condition—and to what extent. It is entirely possible that an extensive nevus flammeus of the face for which care has never been sought but which has made the examinee a recluse would not in fact be significantly changed in the present state of the art.

#### Recording of Findings

There must be a certain rigidity to the recording of data since the information will be transcribed directly from the dermatological forms; key punch operators will work more efficiently when the marks are clear and easily discerned. Red pencil is therefore to be used to highlight observations. Throughout the form the many numbers appearing in parentheses are tape locations and for the examiner's part can be ignored. Boxes to be scored may be checked or X'ed. If an error is made, circle the error, and mark the correct place.

The detail of the form will, to a few examiners, be paralyzing at first. Remembering the overall pattern, however, and becoming familiar with the locations for scoring information should make the recording of data quite facile. It may be expedient to examine the person first, sometimes recording significant diagnoses and observations straight off, but then going over the form section by section at the end of the examination while the examinee is still present, perhaps dressing, but available for checking historical information and forgotten or confused observations.

If the examinee has gone and there is doubt about some finding, it is better to forego the information and err on the side of lost data.

### Mycological Studies

All lesions which you consider to be fungus or to include fungus in the differential are to be scraped. In addition, we want to scrape all scaling lesions of the feet and hands, and all circumscribed scaling lesions anywhere that might be considered "ring worm" not only by the nondermatological physician but by a layman or pharmacist.

The lesion should be scraped with a scalpel or slide, and the scrapings (at least twice what you think is adequate) should be trapped between two glass slides labeled with the sample number and taped securely with scotch tape. The standard Fungus Culture Report form includes space for the sample number and a description, in words, of the location of the scraping. This location is also to be translated into two digits and written on the form in the appropriate place after 131.--/. The last two spaces are reserved for the fungus identification and will be completed by the laboratory. If the clinical impression is not that of fungus the body location must still be cited. The KOH that appears on the slip refers to that done by the laboratory not that done by the examiner in the trailers. Two copies of the form are to be wrapped securely around the slides enclosing the scrapings.

The samplings taken on any examining day are to be packed with cotton in a mailing container and sent that day to:

William Epstein, M.D.  
Department of Dermatology  
University of California Medical Center  
San Francisco, California 94122

The third Fungus Culture Report copy is filed by the nurse and mailed to the Operations Branch at the close of the stand.

Entries should also be made in the Dermatology Record Book at the time of each scraping.

### Biopsies

We take biopsies only from adults who can provide consent. With lesions on the head or neck we biopsy only those that are clinically malignant or that may involve diagnosis or grave importance such as lupus erythematosus, the granulomatous disease, tuberculosis, leprosy, sarcoid, etc. But on covered areas of the body, any significant lesion or any lesion of obscure or uncertain identification can be biopsied provided the examinee understands the reasons for the procedure and consents to the biopsy. Before doing a skin biopsy, you must complete an authorization form which provides for the examinee's signature, dermatologist's signature, a witness' signature, the date, name, and address of the examinee's physician (or health care source) which is essential if the biopsy report is to benefit the examinee.

Pages 1, 2, and 3 should also be completed at the time of the biopsy—these must include a description and clinical impression for each biopsy (number by site if there are more than one) in the "Comments of Examining Dermatologist." Page 1 should be mailed directly from the trailers to the physician (or health care source) listed on the authorization form. Page 2, after having been checked to see that it does not include the examinee's name and address, should be enclosed along with the biopsy specimen bottle in the mailing container and mailed to:

William C. Clendenning, M.D.  
Skin Pathology Laboratory  
Mary Hitchcock Memorial Hospital Clinic  
Hanover, New Hampshire 03755

Page 3, which is a duplicate of page 1, should be stored with the authorization form and mailed to the Operations Branch at the close of the stand.

Appropriate entries should be made in the Dermatology Record Book at the time of each biopsy. Each tissue specimen should be placed in the small formalin containing bottle labeled with the sample number and the site number (if more than one site was biopsied).

Prior to the biopsy every effort should be made to contact the examinee's private physician, if he has one, to discuss with him the reason for biopsy and to assure him he will get a copy of the histopathological report. Therefore, his name and address must be affixed to the biopsy slip. Copies of all biopsy reports will also be returned to the examiner if he identifies them by number (which by code also identifies the caravan location). Remember a name only is of no help.

For biopsies local anesthesia is available as well as sterile drapery, skin punches, and equipment for scalpel surgery. Hemostasis can be achieved by suture or coagulation (electrical or chemical). When lesions are sutured arrangements must be made for their removal either in the trailers, if still in the area, or through another facility or private physician. No courtesy reimbursement can be made to others; hence, it is the serious obligation of the dermatologist who places the sutures to arrange for suitable removal.

### Photography

A Nikon camera is provided for your use. Any lesion biopsied should be photographed if at all possible, especially if it occurs in a cosmetically significant area or if after excision the defect will require suturing. Any other lesion should be photographed if there is some question about the diagnosis or if the lesion is in any way unique.

Prudence in the matter of photography can not be overstressed; persons are often sensitive about photographic documentation. When a physician is rendering service to the patient to be photographed, the patient finds it easier to justify this intrusion of privacy. Not so when the entire examination is one of evaluation by an extensive team unknown to the examinee. The poor publicity that might result from one imprudent photograph could jeopardize the survey as a whole. Careful expla-

nation of the purpose of the photograph should obviate any concern and allow us to obtain sound documentary evidence to corroborate observations. Before any photography takes place however, the consent form must be signed.

Make a record of the photography in the appropriate book and on the form with a coding of the lesion photographed.

### Significant Findings

The major dermatological findings which are to be written on the first page of the form are gleaned from the entire examination and summed at the end of the examining period. Listed on the first page should be all diagnoses that you, the examiner, feel would or should be seen by a dermatologist. Lesions for which little can be done, a nevus flammeus for example or an extensive bathing trunk nevus, would undoubtedly be taken to a dermatologist or should be, at least once. A basal cell tumor that the examinee has never noticed or a Bowen's he disregards should certainly be listed under significant findings. Include also any psoriasis or any lupus erythematosus no matter how small the lesion. On the other hand, seborrheic dermatitis of a mild variety that would respond well to over-the-counter remedies would not be included. There is a place for seborrheic dermatitis under the regional examination of the head and neck and this alone should suffice. Your clinical judgment in these matters is final.

If you have observed a lesion and can find no place to score it, telephone Dr. Johnson so that a place can be agreed upon. If she is unavailable, then record it under significant lesions (even without coding). "Significant dermatological diagnoses made previously but now suppressed or in remission" will depend on your historical review and your clinical judgment. Recorded here will be such things as pemphigus which may be so suppressed by steroids that there are no lesions to be seen. It would not be a place for the scars of past severe herpes zoster. If there are no lesions to be seen, you must judge whether or not the condition was correctly lesions to be seen, you must judge whether or not the condition was correctly diagnosed but is not now apparent because of good therapy or natural remission. If seen at a reputable medical center and if appropriate studies were done and found positive, you might feel the diagnosis was likely and score probable. If you are provided with more corroboration you may be certain.

Coding is based entirely on the "Code of Skin Diseases," the blue book elaborated by the Dermatology Department at New York University—Skin and Cancer. If there is any uncertainty about the number or any omission in the code book, phone Dr. Johnson.

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**CHAPTER 9**  
**OPHTHALMOLOGICAL EXAMINATION**

Equipment

Reliance motor hydraulic chair, instrument stand, and adjustable stool.  
DaLaur lens cabinet.  
Keeler modified pantoscope.  
B & L Copeland streak retinoscope.  
WA Finoff ocular transilluminator with rechargeable handle.  
AO binocular indirect ophthalmoscope with voltage selector, cobalt blue and neutral density filters, and 2x and 3x Volk conoid condensing lenses.  
AO Project-o-chart with slides for Snellen letters, illiterate E, Landolt rings, and pictures, and two mirrors and screen.  
AO Custom Tillyer trial lens set with case.  
B & L Green's Refractor with plus cylinders.  
B & L Ortho-poise trial frame.  
AO Powerite II Lensometer.  
Zeiss Slit Lamp 100/16 model pm/m with applanation tonometer and Hruby lens.  
Goldmann fundus lens and 3 mirror contact lens.  
Berens plastic prism bars - horizontal and vertical.  
Klein Keratoscope.  
Hertel Exophthalmometer.  
Occluders- Lorgnette pinhole, and double end: red lens and occluder.  
Cotton eye patches.  
Transpore tape.  
Cotton tip applicators.  
Fluorescein paper strips.  
Ophthalmic solutions: 10% neosynephrine; ophthaine; 1% methylcellulose; 1,2,4% pilocarpine; 10% sulfacetamide; neosporin; 1% prednisolone; irrigating solution; 1% mydriacil; fluoress; and plastic sterilizing solution (for tonometer).

General

The National Health and Nutrition Examination Survey is a study designed to develop knowledge of the frequency of disease throughout the United States. The National Eye Institute is participating in this survey to determine the prevalence of ocular abnormalities in order to set goals and priorities for future emphasis in the field of ophthalmology. It is a very rare opportunity to examine a sample of the U.S. population, and every effort should be made to use it effectively.



There will be large numbers of ophthalmologists associated with the conduct of this survey, with a wide variety of backgrounds and understanding of what signs and symptoms constitute a given disease entity; for example, superficial punctate keratitis can mean either "small, round, superficial defects in the corneal epithelium," or "small, round, superficial infiltrates in the corneal epithelium."

In order to keep the examination, terminology, and diagnosis as uniform as possible, the text by Newell, *Ophthalmology: Principles and Concepts*, is to be used as quick reference when questions arise. A copy of this text is provided in each examining unit. Also, a copy of the disease classifications to be used by us in coding the data is provided in the trailer for your perusal.

Completeness of examination and recording of both physiologic and pathologic findings is necessary. This is required in order to maintain similar quality of data from day to day. The success of this study depends entirely on the effort and care invested by you to collect and record accurate data. Given such effort, care, and attention to protocol, the future value of this study to ophthalmology can be very great indeed.

There are two types of examinations given to the examinees—a nutritional examination for which eight persons are scheduled during each examining session, and a detailed examination for which two are scheduled each session. The ophthalmology examination forms for each type of exam are identical except that for the detailed exam there is added 1) maxillary transillumination, and 2) retinoscopy for any eye in which best visual acuity is 20/50 or less.

#### Examination Procedure

The examinee will be brought to the ophthalmic examining room by the coordinator along with a time sheet (in many examination sites), the ophthalmic examination form, and a sheet entitled "Report of Findings." Please do not go up to the front of the trailer to get the examinee yourself; the coordinator has a prescribed examinee flow system to follow.

IT IS IMPORTANT THAT ALL DATA BE WRITTEN LEGIBLY WITH BLUE OR BLACK INK—the examinations will be coded by people unfamiliar with your handwriting (do not use pencil or red ink).

#### Time Sheet

		Time		
		In	Out	
7.	Ophthalmology I	015	016	Reason not done:
8.	Ophthalmology II	017	018	Reason not done:

If a time sheet is present, record the time at which the ocular examination is begun (015), time when dilating drops instilled and the examinee returned to the coordinator (016), time when the examinee returns for the fundus examination

(017), and the time when the total eye exam is completed (018). If for any reason either portion of the eye examination was not done, please specify the reason.

There has been allotted 20 minutes for the complete ocular examination of each person. The examinations must be done quickly, but at the same time accurately. Try to do the first portion of the eye exam in about 9 minutes, and the second part in about 6 minutes. The maximum time allowed is 20 minutes (12 and 8). This time requirement is necessary to insure that all examinees will be seen during the time limits of the session. If for some reason the examination is not finished within the allotted time, return the examinee to the coordinator, and on the time sheet write "maximum time" in the space provided for REASON NOT DONE.

### 1. Introductory Data

a. Deck No.	b. Sample No.	c. Sex	d. Age	e. Examiner No.	f. Name of Examiner
161	_____	1 <input type="checkbox"/> Male 2 <input type="checkbox"/> Female	__	__	

At the top of the ophthalmic examination form write the examinee's sample number (this is stamped on the bottom right hand corner of the control record), and enter the appropriate sex and age (a two-digit number in years) obtained by questioning the examinee. The age of the examinee should be recorded as the age at last birthday, not one which is expected to be reached during the following weeks or months. Also add your examiner number, and last name. Your examiner number will be posted on the wall of the examination room.

### 2. General information

A quick check list is provided on the exam sheet for some of the more common ocular disorders; if one or more conditions are present, mark the appropriate boxes. Diagnostic definitions for motility, nystagmus, and for sections J through S are contained in the Disease Definition section.

Under "Other" in all sections in which "other abnormalities" are asked for, include all physiologic and pathologic changes found which are not on the check list. Please specify the abnormal findings in the spaces provided. These might be such conditions as papilloma of the lids, choroidal nevi, vitreous prolapse, Bergmeister's papillae, etc.

IT IS IMPORTANT THAT ALL DATA BE FILLED IN—IF A PARTICULAR SEGMENT OF THE EYE EXAMINATION IS NORMAL, "NOABNORMALITY" MUST BE CHECKED...

If both eyes have the abnormality, check OU (not OD, OS, OU); if no abnormal findings are present, check "No abnormality" OU. If abnormal findings are present in one eye and not the opposite (e.g., OD findings), then check "No abnormality" for the uninvolved eye (e.g., OS). This applies to all sections of the form whenever OD, OS, or OU are to be checked.

If for any reason a particular portion of the eye could not be examined, draw a large "X" through that particular segment on the examination sheet. Without this, we cannot tell whether a given portion of the eye was not present or not examined. For example, if an individual had one eye enucleated, then draw a line through those portions of the ocular exam for that eye which were not done, i.e., visual acuity, tonometry, cornea, etc.

The examination should be carried out according to the sequence on the exam form except for lids, globe, conjunctiva, cornea, sclera, anterior chamber, and iris evaluation which should be done prior to tonometry and dilatation.

### 3. Significant ocular history

<p><b>A. SIGNIFICANT OCULAR HISTORY</b></p> <p>1. Surgery – <input type="checkbox"/> Strabismus    <input type="checkbox"/> Cataract</p> <p>2. Other –    <input type="checkbox"/> Injury            <input type="checkbox"/> Infection</p> <p>3. Other – Specify _____</p>	<p>① 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No</p> <p>② _____</p> <p>③ _____</p> <p>④ _____</p>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------

Ask the examinee: "Have you ever had any problems or diseases of the eyes for which you saw a physician, eye specialist, or an optometrist?" If the examinee says "Yes," then ask "What was your problem?"

Check the box marked "Yes" if the examinee has seen a specialist for any condition, excluding refraction; this will include such minor conditions as styes, subconjunctival hemorrhage, red eyes, vitreous floaters, etc. If the examinee has not seen any of the above individuals for problems with his eyes, check "No."

Four common conditions are provided as a check-list: strabismus surgery, if the examinee has had corrective cosmetic or therapeutic muscle surgery for comitant or incomitant strabismus; cataract surgery, if the examinee has had any surgical intervention involving the lens; injury, if the examinee has had any minor conditions such as snow blindness, "welder's burn," foreign body removal ( by a specialist), or more serious conditions, such as "blow-out fractures" or global lacerations; and infections, if the examinee has sought and received treatment for any ocular infection, including external as well as internal infections (conjunctivitis, uveitis, etc.).

For "Other" conditions in the past ocular history, a few words will be sufficient, such as: hyperthyroid myopathy, vitreous floaters, don't know, etc. If the section labeled "Significant Ocular History" is checked "Yes", then one

of the boxes in the history section should also be checked. Whenever something is checked or entered in the history section, Box 001 should be checked "Yes."

#### 4. Visual Acuity

<b>B. VISUAL ACUITY</b>			
1. Optotype used . . . . .	1.	(005) 1 <input type="checkbox"/> Snellen	3 <input type="checkbox"/> Landolt
		2 <input type="checkbox"/> Ill. E	4 <input type="checkbox"/> Picture
2. Acuity cc OD _____	2.	(006) * _ _	
OS _____		(007) * _ _	
sc OD _____		(008) * _ _	
OS _____		(009) * _ _	
3. If not 20/20, pinhole (Acuity) . . . . .	3.		
OD _____		(010) * _ _	
OS _____		(011) * _ _	
* To be entered by coder			

Do not examine visual acuity of children three years of age or younger. For all others the order of preference for using the test symbols is: 1) Snellen letters, 2) Illiterate "E," 3) Landolt ring, and 4) Picture. Enter the optotype used on the examination sheet in item 005.

Visual acuity examination should be done with all light in the examining room turned off, except for the overhead lamp on the Reliance Instrument Stand, which should be turned on dim and aimed toward the corner wall above the blue cabinet.

Only test distance acuity. If the examinee has brought his glasses to the exam center, examine his corrected acuity in preference to uncorrected, even if it is necessary to recover glasses from his clothes locker. It is not necessary to determine uncorrected acuity if corrected acuity is available.

The visual acuity should be taken by beginning with the larger Snellen letters on the projector chart, and then decreasing their size until a complete line cannot be read; if an individual appears to have good vision, the examiner may begin with the 20/30 line or 20/25 line and go to the 20/20 line.

Record the visual acuity as the smallest complete line (no more than one test symbol missed), plus any letters read on the next line (e.g., 20/30 + 3, not 20/25 - 3). In cases where the visual acuity is less than 20/400, use finger

counting (CF) and specify the distance, hand movements (HM), light perception with projection (LPP), light perception only (LP), or no light perception (no LP).

Occasionally, because of an uncorrected astigmatism, an individual may miss one or two letters on several succeeding larger visual acuity lines. If this occurs, give the examinee credit for the next largest line above the lowest line in which the letters are missed, plus credit for those letters correctly determined on the lower line.

If the best vision is not 20/20 in either eye, obtain pinhole acuity for that eye also. Place the pinhole over the examinee's correction. Circle CC if vision tested with examinee's glasses or contacts on; circle SC if vision tested without glasses.

### 5. Motility

C. MOTILITY	
1. Tropia . . . . . 1.	(012) 1 <input type="checkbox"/> Eso                    2 <input type="checkbox"/> Exo                    3 <input type="checkbox"/> Neither (013) 1 <input type="checkbox"/> Hyper                    2 <input type="checkbox"/> Not hyper (014) 1 <input type="checkbox"/> Comitant                    2 <input type="checkbox"/> Incomitant
2. Phoria . . . . . 2.	(015) 1 <input type="checkbox"/> Eso                    2 <input type="checkbox"/> Exo                    3 <input type="checkbox"/> Neither (016) 1 <input type="checkbox"/> Hyper                    2 <input type="checkbox"/> Not hyper
3. Nystagmus . . . . . 3.	(017) 1 <input type="checkbox"/> Pendular                    4 <input type="checkbox"/> Jerk-rotary 2 <input type="checkbox"/> Jerk-horiz.                    5 <input type="checkbox"/> No nystagmus 3 <input type="checkbox"/> Jerk-vert.

All examinees are to be tested in the six cardinal directions of gaze. Then the alternate-cover test and the cover-uncover test should be done at near (14 inches) and distance (20 feet) with an accommodative fixation target (e.g., fixation symbol for near and 20/40 letter for distance). Motility examination should be done with vision corrected if glasses are available, and through bifocals or reading glasses if available.

The examinee can be checked in the cardinal directions by having him follow a near fixation target while you look for limitations of gaze. The cover-uncover test (for tropia) is performed by having the examinee observe a stationary accommodative test object while you cover one eye and look for movement of the fellow eye. Repeat the same procedure for the opposite eye. The alternate cover test (for phoria) is performed by covering one eye and then the other, looking for movement of the uncovered eye. By these techniques, phorias and tropias may be detected and differentiated.

If a tropia is present, be sure to check all three lines: eso-exo, hyper-not hyper, and comitant-incomitant; if no tropia is present, check "Neither," but do not check "hyper-not hyper" or "comitant-incomitant." If a phoria is present, be sure to check both lines: "eso-exo," and "hyper-not hyper," if no phoria is present, check "Neither," but do not check "hyper-not hyper." When a tropia is present, leave the phoria section blank.

The presence or absence of nystagmus can be looked for when doing the muscle examination; do not consider voluntary or end-position nystagmus as true nystagmus.

## 6. Pupils

D. PUPILS		OD	OS	OU
1. Anisocoria-location .....	1.	(018) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
a. -(mm) .....	a.	_____	_____	_____
2. Absent light reflex				
a. Direct .....	2a.	(019) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Consensual .....	b.	(020) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Other - Specify _____				
_____	3.	(021) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. No abnormality .....	4.	(022) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

Note the size and regularity of the pupils; if there is one millimeter difference between the pupil sizes of the two eyes, check the box for the larger eye under "Anisocoria (ignore location)." If there is sector involvement of one eye, check the box for that eye. Record the measurements in millimeters for both eyes if anisocoria is checked. The pupils do not have to be routinely measured. Disregard OU in anisocoria (box 018) as well as measurement of pupils OU; these are marked with an "X."

The direct light reflex can be elicited, in the normally lighted room, by directing the beam of the Finoff ocular transilluminator directly into one of the examinee's eyes from a distance of approximately three inches and observing pupillary contraction. The examinee should be fixating at distance to avoid the near reflex response. The consensual reflex can be performed by observing the pupillary response in the fellow, nonstimulated eye. Repeat for the second eye. Record findings if the pupillary reflex is absent or barely perceptible.

## 7. Lids

J. LIDS		OD	OS	OU
1. Blepharitis . . . . .	1.	(059) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
a. Angular . . . . .	a.	(060) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Chalazion . . . . .	2.	(061) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Concretions . . . . .	3.	(062) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Ectropion . . . . .	4.	(063) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. Entropion . . . . .	5.	(064) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
6. Hordeolum . . . . .	6.	(065) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
7. Ptosis . . . . .	7.	(066) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
8. Other - Specify _____				
_____ 8.		(067) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
9. No abnormality . . . . .	9.	(068) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

The examination of the lids should be done by gross examination, using the Finoff hand illuminator in a fully illuminated room, followed by slit lamp evaluation of the lid margins under low magnification (8-10x).

## 8. Globe

K. GLOBE		OD	OS	OU
1. Enucleation . . . . .	1.	(069) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Exophthalmos . . . . .	2.	(070) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
a. Measurement . . . . .	a.	_____	_____	_____
b. Base . . . . .	b.	_____	_____	_____
3. Microphthalmos . . . . .	3.	(071) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
a. Measurement (mm) . . . . .	a.	_____	_____	_____
4. Other - Specify _____				
_____ 4.		(072) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. No abnormality . . . . .	5.	(073) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

If exophthalmos (including proptosis) is present, it is important to record the actual Hertel measurements, and the base used. It is necessary to use the Hertel only when abnormalities are suspected.

If microphthalmus is suspected, record the horizontal corneal diameter from external limbus to external limbus in millimeters. Otherwise, it is not necessary to measure normal-appearing corneas.

## 9. Conjunctiva

L. CONJUNCTIVA		OD	OS	OU
1. Bitot's spot . . . . .	1.	(074) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Conjunctivitis				
a. Allergic . . . . .	2a.	(075) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Follicular . . . . .	b.	(076) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. Infectious . . . . .	c.	(077) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(1) Bacterial - Specify <u>                    </u>	(1)	(078) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(2) Viral - Specify <u>                    </u>	(2)	(079) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Follicles (no inflammation) . . . . .	3.	(080) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Inclusions . . . . .	4.	(081) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. Pingueculum . . . . .	5.	(082) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
6. Xerosis . . . . .	6.	(083) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
7. Other - Specify <u>                    </u>	7.	(084) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
8. No abnormality . . . . .	8.	(085) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

Examine the conjunctiva by gross inspection and using the low magnification (8-10x) on the slit lamp. If the clinical evidence is sufficient to make a probable diagnosis of an etiologic agent in infectious conjunctivitis, then write it in after "Bacterial" or "Viral."

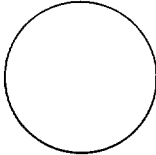
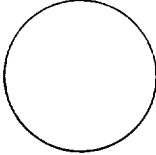
## 10. Sclera

M. SCLERA		OD	OS	OU
1. Ectasia . . . . .	1.	(086) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Episcleritis . . . . .	2.	(087) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Scleritis . . . . .	3.	(088) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Other - Specify <u>                    </u>	4.	(089) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. No abnormality . . . . .	5.	(090) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

Gross examination of the sclera is sufficient.



11. Cornea

N. CORNEA		OD	OS	OU
1. Arcus senilis . . . . .	1.	(091) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Band keratopathy . . . . .	2.	(092) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Degeneration - Specify _____	3.	(093) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Dystrophy - Specify _____	4.	(094) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. Edema				
a. Epithelial . . . . .	5a.	(095) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Stromal . . . . .	b.	(096) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
6. Endothelial KP's . . . . .	6.	(097) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
7. Guttata . . . . .	7.	(098) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
8. Keratitis - Specify _____	8.	(099) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
9. Keratomalacia . . . . .	9.	(100) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
10. Krukenberg spindle . . . . .	10.	(101) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
11. Opacity - Specify _____	11.	(102) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
a. Superficial stromal . . . . .	a.	(103) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
12. Pterygium . . . . .	12.	(104) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
13. Vessels - Specify _____	13.	(105) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
14. Other - Specify _____	14.	(106) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
15. No abnormality . . . . .	15.	(107) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
		(108) 1 <input type="checkbox"/> Location shown		
16. Diagram location of abnormalities . . .	16.	OD	OS	
				

The cornea should be screened using the low magnification of the slit lamp; abnormalities found may be examined by higher power. If corneal abnormalities are found, describe and label them in the diagram provided on the examination sheet; e.g., Bowman membrane level; nebula, macula, or leukoma. Also indicate whether active or inactive. A one or two word descriptive label will suffice in most cases.

12. Anterior chamber

O. ANTERIOR CHAMBER		OD	OS	OU
1. Cells . . . . . 1.	(109)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Flare . . . . . 2.	(110)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Other - Specify _____ _____ 3.	(111)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. No abnormality . . . . . 4.	(112)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

In examining the anterior chamber for flare, the slit lamp beam should be changed to the small round dot of light directed toward the pupil at about a 60° angle. Do not use the high intensity light overload for the evaluation of flare and cell.

13. Iris

P. IRIS		OD	OS	OU
1. Synechiae				
a. Anterior . . . . . 1a.	(113)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Posterior . . . . . b.	(114)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Atrophy . . . . . 2.	(115)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Coloboma . . . . . 3.	(116)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Iritis . . . . . 4.	(117)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. Neovascularization . . . . . 5.	(118)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
6. Other - Specify _____ _____ 6.	(119)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
7. No abnormality . . . . . 7.	(120)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

The iris should be examined using the low power of the Zeiss microscope (8-10x); iris atrophy can be evaluated by directing the light beam through the pupil into the posterior chamber, and looking for transmission of light through iris tissue. If peripheral anterior synechiae are suspected, gonioscopy may be performed to confirm the impression.

## 14. Tonometry

E. TONOMETRY (Examinees 20 years and over)		Applanation	
		OD	OS
Three readings			
Time of test	_____ a.m. _____ p.m.	(023) ---	(024) ---
<input type="checkbox"/> Unsatisfactory test (Code 99 in space 023)		(025) ---	(026) ---
		(027) ---	(028) ---

Applanation tonometry will be performed on all individuals age 20 years and older; if for any reason tonometry is unsatisfactory or can not be completed, check "Unsatisfactory test code." For example, if it is necessary to hold the lids open for tonometry because of lid squeezing reflex or if the upper lid rests on the tonometer during the measurement, check the test as unsatisfactory since these two conditions may artificially elevate the intraocular pressure or give a falsely high reading. However, still record the intraocular pressure. If it is a case of a loose senile lid, resting on the tonometer, which can easily be elevated without eliciting a squeeze reflex, the test should be considered as satisfactory.

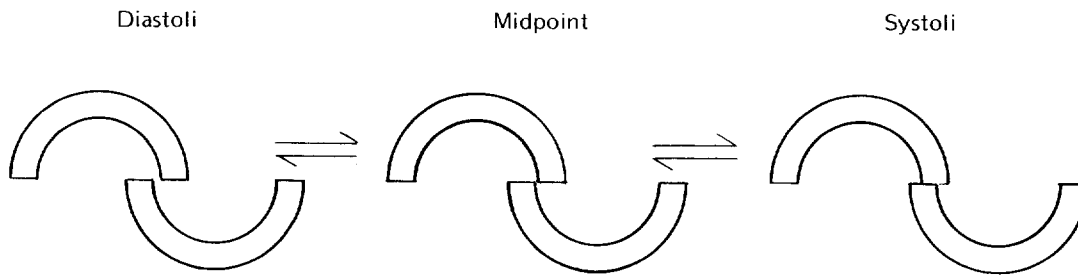
Ignore "code 99 in space 023." Record the hour the test was done, and cross out AM or PM, whichever does *not* apply.

The applanation tonometry should be done according to the following technique. One drop of .1% fluoress is to be instilled in each eye. Three readings are to be taken on each eye, beginning with the right eye. Take the readings on each eye consecutively; reposition the tonometer and turn the measuring scale to 10 mm Hg between each reading. The magnification should be 8-10x.

Fluoress contains a topical anesthetic; additional anesthetic should not be added since this dilutes the fluorescein concentration. The tension should be measured soon after instilling the fluoress; by waiting a period of time the fluorescein will also become diluted.

The slit illuminating aperture should be opened fully and positioned at about a 60° angle to the slit lamp. Bring the prism in contact with the cornea, the point at which the limbus shines with a bluish light (observed by the naked eye from the side opposite to the illumination). Correct the position so that the two semi-circles are of equal size and located in the middle of the field of view. Turn

the measuring drum on the tonometer until the inner borders of the two fluorescein rings just touch each other: this should be the midpoint of each pulsation



of the eye (see diagram). Read the pressure from the measuring drum; record to the nearest millimeter of mercury. The measuring dial should not be observed until the end point is reached in order to keep the measurement objective.

### 15. Dilatation

*Anterior segment check prior to dilatation.*

<p><b>F. DILATATION</b> (1 gtt. 10% Phenylephrine OU)</p>	<p>029 1 <input type="checkbox"/> Not dilated  <input type="checkbox"/> Suspicious anterior chamber  <input type="checkbox"/> History of angle closure  <input type="checkbox"/> Unable to instill gtts.</p> <p>2 <input type="checkbox"/> Mydriasis inadequate for fundus copy</p> <p>3 <input type="checkbox"/> Dilatation adequate</p>
---------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Before dilatation ask the examinee about symptoms compatible with attacks of acute narrow angle glaucoma, e.g., transient blurring of vision associated with ocular pain or frontal headache, etc.

Check the anterior chamber depth prior to dilatation. Direct the slit beam of the illuminator at about 60° toward the anterior chamber just inside the limbus. A good estimate of the distance of the iris root from the corneal endothelium can be obtained. If the separation is slit-like, or less than ¼ the corneal width, gonioscopy is recommended to rule out the possibility of angle closure. Also gonioscope if there are symptoms suggestive of angle closure. Gonioscopy need be performed only when indicated by the appearance of the anterior chamber or symptoms.

If gonioscopy is performed, estimate the angle at the narrowest area in each eye and record the angle in degrees in the space under "F. Dilatation," e.g., 30° OD, 15° OS.

Do not dilate if the angle is 10° or narrower in any area.

For dilatation use 1% mydriacyl (instead of 10% phenylephrine as listed) as the mydriatic agent. Young (50 years old and under) hyperopic individuals without corrective lenses who will be driving immediately after the examination may be dilated with 10% phenylephrine. This will cause less of a blurring effect to these individuals. The dilating drops may be repeated if necessary.

If the examinee was not, or could not, be dilated, check the appropriate box.

At this point, the examinee should be returned to the coordinator. Do not forget to fill in the time sheet (if present). The examinee will have additional examinations done while the eyes are dilating, and will be returned for completion of the examination after the lapse of approximately 20-70 minutes; maximum time between the two parts of the examination should not be longer than 70 minutes. If the interval is longer than 70 minutes, check with the coordinator to determine the cause of the delay. New examinees for the initial examination will be brought in by the coordinator during this time. The examination form goes with the examinee. Consult the coordinator at the end of the session to determine if all the examinees have been returned to you for completion of the ophthalmic exams.

When the examinee has been returned for the second part of the examination, record the time. Also record whether dilatation was adequate for the fundus evaluation. Dilatation will be considered adequate if the pupil is sufficiently dilated to visualize the posterior pole out to the second major branchings of the arterial system.

#### 16. Maxillary sinus transillumination

H. MAXILLARY SINUS TRANSILLUMINATION			
1. Right .....	1.	033	1 <input type="checkbox"/> Normal    2 <input type="checkbox"/> Dull    3 <input type="checkbox"/> Opaque
2. Left .....	2.	034	1 <input type="checkbox"/> Normal    2 <input type="checkbox"/> Dull    3 <input type="checkbox"/> Opaque

This is to be done on the detailed examination only. In a dark room with the examinee's mouth open (and dentures or plates removed) judge both the right and left maxillary sinuses as (1) normal, (2) dull, or (3) opaque, based upon the amount of light transmitted to the mouth from an optic transilluminator placed over the inferior rim along the floor of the orbit. Ordinarily, a bright glow should be observed from the roof of the mouth on the side transilluminated. In chronic sinusitis the amount of light passing through the maxillary sinus is often impeded.

17. Refraction

**NUTRITION EXAM**

I. REFRACTION	Eye	Sphere		Cylinder		Axis
	1. Present glasses	OD	035	036	037	038
1 <input type="checkbox"/> +				1 <input type="checkbox"/> +		°
2 <input type="checkbox"/> -		_____ D	2 <input type="checkbox"/> -	_____ D	_____ °	
OS		040	041	042	043	044
	1 <input type="checkbox"/> +		1 <input type="checkbox"/> +		°	
2 <input type="checkbox"/> -	_____ D	2 <input type="checkbox"/> -	_____ D	_____ °		
2. If acuity less than 20/40, any improvement with spheres	Eye	Sphere		VA		
	OD	045	046	050		
		1 <input type="checkbox"/> +		_____		
	2 <input type="checkbox"/> -	_____ D	c* _____			
OS	052	053	057			
	1 <input type="checkbox"/> +		_____			
2 <input type="checkbox"/> -	_____ D	c* _____				
* To be entered by coder						

**DETAILED EXAM**

I. REFRACTION	Eye	Sphere		Cylinder		Axis	VA	PH
	1. Present glasses	OD	035	036	037	038	039	
1 <input type="checkbox"/> +				1 <input type="checkbox"/> +		°		
2 <input type="checkbox"/> -		_____ D	2 <input type="checkbox"/> -	_____ D	_____ °			
OS		040	041	042	043	044		
	1 <input type="checkbox"/> +		1 <input type="checkbox"/> +		°			
2 <input type="checkbox"/> -	_____ D	2 <input type="checkbox"/> -	_____ D	_____ °				
2. If acuity less than 20/40, retinoscopy	OD	045	046	047	048	049	050	051
		1 <input type="checkbox"/> +		1 <input type="checkbox"/> +		°	_____	_____
	2 <input type="checkbox"/> -	_____ D	2 <input type="checkbox"/> -	_____ D	_____ °	c* _____	c* _____	
	OS	052	053	054	055	056	057	058
1 <input type="checkbox"/> +			1 <input type="checkbox"/> +		°	_____	_____	
2 <input type="checkbox"/> -	_____ D	2 <input type="checkbox"/> -	_____ D	_____ °	c* _____	c* _____		
* To be entered by coder								

Record only the distance correction for the most recent glasses (not reading add or reading glasses). Mark the appropriate plus or minus box to indicate the power of the sphere and cylinder. Directions for using the lensometer have been placed on the wall next to the instrument.

If the best vision in either eye is 20/50 or worse, corrected or uncorrected, (not including pinhole vision) the following examination should be done after the pupil has been dilated:

*For the nutrition examinees*—try to improve the vision using simple spheres in .50 diopter increments (e.g., +2.50, -1.00, etc.) from the trial lens set placed in front of the eye with the poor vision, keeping the glasses on. Record the added spherical correction and the final vision obtained; also mark the box designating whether the added lenses were plus or minus spheres.

*For the detailed examinees*—using the Copeland streak retinoscope, determine the refractive error; without doing a manifest refinement, measure the visual acuity and record. If the acuity is not 20/20, place a pinhole over the retinoscopy findings and record this visual acuity also. Record the vision obtained as the smallest completed Snellen line (no more than one symbol missed). Directions for using the Copeland retinoscope are posted on the examining room wall.

The spherical refraction and retinoscopy should be done with the room lights out except for the instrument stand light over the blue cabinet; use the trial frames in preference to the "Greens' Refractor."

18. Lens

Q. LENS		OD	OS	OU
1. Aphakia	1.	(121) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Cataract				
a. Immature	2a.	(122) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Intumescent	b.	(123) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. Mature	c.	(124) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
d. Hypermature	d.	(125) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
e. Morgagnian	e.	(126) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Opacity				
a. Anterior polar	3a.	(127) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Cortical	b.	(128) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. Nuclear	c.	(129) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
d. Post subcapsular	d.	(130) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Pigment on surface	4.	(131) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. Other — Specify _____				
_____	5.	(132) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
6. No abnormality	6.	(133) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

The lens should be evaluated both by the slit lamp, and then by the direct ophthalmoscope (+10 lens). Only opacities observed by both instruments will be considered as opacities for the purpose of this study (except for decreased lucency of the nucleus—nuclear sclerosis—which may be observable only with the slit lamp). Nuclear sclerosis should be checked as a nuclear opacity.

### 19. Vitreous

R. VITREOUS	OD	OS	OU
1. Detachment . . . . . 1.	(134) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Hemorrhage . . . . . 2.	(135) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3. Opacity - Specify _____ _____ 3.	(136) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4. Other - Specify _____ _____ 4.	(137) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5. No abnormality . . . . . 5.	(138) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

If the type or cause of vitreous opacity can be identified, please specify whenever possible.

### 20. Retina

S. RETINA	OD	OS	OU
1. Disc			
a. Drusen . . . . . 1a.	(139) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. Glaucomatous cup . . . . . b.	(140) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. Neovascularization . . . . . c.	(141) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
d. Optic atrophy . . . . .			
(1) Primary . . . . . d(1)	(142) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(2) Secondary . . . . . (2)	(143) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
e. Papilledema . . . . . e.	(144) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
f. Papillitis . . . . . f.	(145) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
g. Other - Specify _____ _____ g.	(146) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2. Macula			
a. Degeneration			
(1) Senile . . . . . 2a(1)	(147) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(2) Disciform . . . . . (2)	(148) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(3) Circinate . . . . . (3)	(149) 1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>



**S. RETINA - Continued**

- b. Diabetic involvement ..... b. (150) 1  2  3
- c. Edema ..... c. (151) 1  2  3
- d. Hypertensive involve. .... d. (152) 1  2  3
- e. Pigment epith. detach. .... e. (153) 1  2  3
- f. Other - Specify \_\_\_\_\_ f. (154) 1  2  3

**3. Vessels**

**a. Arteries**

- (1) Branch occlusion ..... 3a(1) (155) 1  2  3
- (2) Central occlusion ..... (2) (156) 1  2  3
- (3) Gen. narrow (1-4) ..... (3) (157) 1  2  3
- (4) Sclerosis (1-4) ..... (4) (158) 1  2  3

**b. Veins**

- (1) Branch occlusion ..... 3b(1) (159) 1  2  3
- (2) Central occlusion ..... (2) (160) 1  2  3
- (3) Dilatation ..... (3) (161) 1  2  3
- (4) Sausaging ..... (4) (162) 1  2  3
- (5) Sheathing ..... (5) (163) 1  2  3
- (6) Tortuosity ..... (6) (164) 1  2  3

**c. Capillaries**

- (1) Microaneurysms ..... c(1) (165) 1  2  3
- (2) Neovascularization ... (2) (166) 1  2  3

d. Other - Specify \_\_\_\_\_  
\_\_\_\_\_ d. (167) 1  2  3

**4. Exudates**

- a. Cotton wool ..... 4a. (168) 1  2  3
- b. Hard ..... b. (169) 1  2  3
- c. Waxy ..... c. (170) 1  2  3
- d. Other - Specify \_\_\_\_\_ d. (171) 1  2  3

**5. Hemorrhages**

- a. Choroidal ..... 5a. (172) 1  2  3
- b. Preretinal ..... b. (173) 1  2  3
- c. Retinal .....
  - (1) Deep ..... c(1) (174) 1  2  3
  - (2) Superficial ..... (2) (175) 1  2  3
- d. Other - Specify \_\_\_\_\_ d. (176) 1  2  3

**6. Pigment changes**

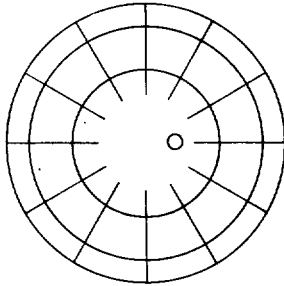
- a. Choroidal ..... 6a. (177) 1  2  3
- b. Epithelial

**5. RETINA - Continued**

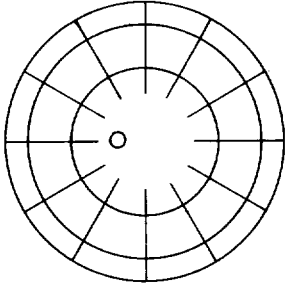
(1) Atrophy .....	b(1)	178	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(2) Hyperplasia .....	(2)	179	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. Other - Specify _____	c.	180	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
7. Angioid streaks .....	7.	181	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
8. Detachment .....	8.	182	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
9. Drusen .....	9.	183	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

10. Inflammation		OD	OS	OU	
a. Chorioretinitis - Specify					
_____ 10a.		184	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(1) Active .....	(1)	185	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
(2) Inactive .....	(2)	186	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
11. Retrolental fibroplasia .....	11.	187	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
12. Other - Specify _____	12.	188	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
13. No abnormality .....	13.	189	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
14. Not visualized .....	14.	190	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
15. Diagram location of retinal abnormalities .....	15.	191	1 <input type="checkbox"/>	Location shown	

OD



OS



Do not use the Goldmann or Hruby lenses to routinely examine the fundus. However, they may be used if pathology is suspected.

The indirect ophthalmoscope should not be used for routine examination of the examinee because dilatation has not been uniformly adequate for evaluation of

the peripheral retina and because not all examiners have been proficient in the use of the instrument. Data prevalence would thus be affected by this lack of uniformity.

Specify whenever possible the etiology of the chorioretinitis, e.g., toxoplasmosis, histoplasmosis, luetic, sarcoid, toxocara, traumatic, etc.

Diagram the location of fundus pathology; a simple one or two word label will be sufficient. The structure of the diagram corresponds to the usual retinal drawing sheet; i.e., tips of the spokes are at the 3rd order vessel bifurcation, and the circles are at the equator, ora serrata, and pars plana.

21. Ophthalmic diagnosis

T. OPHTHALMIC DIAGNOSIS	(192) 1 <input type="checkbox"/> Incomplete exam. 2 <input type="checkbox"/> No abnormality 3 <input type="checkbox"/> Abnormality									
	Code	Condition decreases vision	Treatment			Eye affected				
			Needed	Under care	Not needed	OD	OS	OU		
1. Amblyopia . . .	193 1 <input type="checkbox"/> Present	194 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	195	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	196	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
2.	197	198 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	199	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	200	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
3.	201	202 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	203	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	204	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
4.	205	206 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	207	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	208	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
5.	209	210 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	211	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	212	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
6.	213	214 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	215	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	216	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

In box "192" are: (1) incomplete exam, (2) no abnormality, and (3) abnormality. Check as many of these as are applicable.

An examination is incomplete when any portion of the eye examination has not been completed; e.g., omitted applanation tension on an individual over 20 years, omitted funduscopic examination because of inadequate dilatation or dense corneal opacities, absence of an eyeball precluding its examination. "Abnor-

mality" should be checked if any physiologic or pathologic changes were found during the course of the examination, i.e., if specific abnormalities were checked or entered under "Other" on the check list. "Abnormality" does not include refractive error, phoria, arcus senilis, benign melanosis, concretions, pingueculum, inclusions, or follicles. Check "No abnormality" if only one or more of the above eight conditions were found; if the examination was incomplete and no pathology found, check both "Incomplete examination" and "No abnormality."

In the diagnostic section list all changes, pathologic and physiologic, found as a result of the examination except for the following: refractive error, phoria, arcus senilis, pingueculum, benign melanosis, concretions, inclusions, or follicles. However, if the refractive error is associated with other ocular pathology, like myopia and Fuch's spot or peripheral retinal degeneration, list the refractive condition as a diagnostic entity (as degenerative, pathologic, progressive, or malignant myopia) and check "Abnormality." Give diagnostic entities whenever possible in preference to findings, e.g., histoplasmic chorioretinitis rather than chorioretinitis. Also, make every effort to specify etiology whenever possible, e.g., corneal scar secondary to trauma or to surgery, or to herpes simplex.

Do not repeat the checklist findings if covered by a diagnostic entity; e.g., microaneurysms, neovascularization, hard and waxy exudates may be all part of diabetes mellitus. For example, enter diabetic retinopathy as the diagnosis, but don't enter microaneurysms, exudates, etc., on which the diagnosis of diabetic retinopathy is based. These detailed findings should have been checked off in the examination section and are to be repeated in this final summary only if they are not part of a more general diagnosis.

If the lens, cornea, extraocular muscles, etc., have become involved in the diabetic process list these separately, i.e., cataract secondary to diabetes mellitus, iris neovascularization secondary to diabetes mellitus, etc. In general, wherever possible, combine detailed findings into broader diagnostic categories for the following parts of the eye:

Eyelids	Iris and pupil
Conjunctiva	Choroid
Cornea	Lens
Sclera	Vitreous
Anterior chamber	Retina
	Optic nerve

Occasionally, there may be more than five diagnostic entries possible (in addition to amblyopia); list the more important conditions first, i.e., those conditions that need treatment and those that cause decrease in visual acuity. If more than five diagnoses are present, continue on the bottom of the page.

For the amblyopia diagnosis, check "Present" if the vision could not be corrected to 20/30 or better and resulted from a strabismic or anisometropic condition (difference in refractive error between the two eyes); do not check if loss of vision is due to other causes.

It is important that the diagnosis be supported by findings coded on the examination sheet, sometimes supplemented by the reported history. This is so that we can verify the diagnosis if necessary. Do not include conditions that existed in the past and which do not show any evidence on the present examination; these should be noted in the history.

*Indicate if each diagnosis does or does not contribute to transient or permanent decrease in distance vision (that is, any vision less than 20/20 in the involved eye).*

*Indicate for each diagnosis whether (1) treatment is needed but not now received, (2) treatment is needed and is now received, or (3) treatment is not needed.*

Consider a condition as needing treatment if you feel that treatment should be provided at the time of the examination. For example an examinee with narrow angles would not be considered to require treatment, whereas an examinee with occluded angles would need treatment. An adult with divergent strabismus would not be considered to require treatment although cosmetic surgery might be helpful to him. An examinee with cataracts and 20/40 vision would not need surgery, whereas one with 20/200 vision would likely need treatment.

*Indicate the eye affected for each diagnosis.*

## Report of Findings

---

Ophthalmological (  No new significant findings )

---

Visual Acuity	<input type="checkbox"/> Without glasses	<input type="checkbox"/> Not tested
R Eye L Eye	<input type="checkbox"/> With glasses	
20/ 20/	<input type="checkbox"/> With contacts	

---

Under "Ophthalmological" on the "Report of Findings" (next to last page of the examinee's chart) indicate the diagnostic conditions needing followup and the need for new glasses where such need exists. If there are no new significant findings, indicate this by checking the appropriate box.

Write in the space provided the visual acuity of each eye and check whether it is with or without glasses or contact lenses. If visual acuity was not tested, check that box.

If any questions arise during the course of the examination about the conduct of the study, instruments, or solutions, do not hesitate to call either:

Dr. Arthur Garcia (301) 496-1332

or

Dr. James Ganley (301) 496-1331

from one of the telephones located at the examination center.

#### Disease Definition

The following pages describe those diseases specifically listed on the Ophthalmology Examination Form. For each condition listed in the form a definition, description, or qualification is made. Any condition that is checked off on the examination sheet must conform to the definition of the entity provided below. For example, a cataract is defined as a lenticular opacity consistent with, or associated with, loss of vision; it is not defined as lenticular opacity. These definitions, for the most part, have been taken from Dr. Frank W. Newell's *Ophthalmology, Principles and Concepts*.

Many of the definitions may not agree with an ophthalmologist's current understanding of that particular disease. The purpose of defining each disease is to provide consistency and uniformity of diagnostic impression. The ophthalmic examinations are being conducted by physicians from all areas of this country, each having different ophthalmic backgrounds and levels of training. For example, one physician may consider any lenticular opacity as a cataract, and rightly so, while another physician, even from the same program, may consider a cataract as a visually impairing process. The prevalence of cataract would vary from very high, as defined as lenticular opacity, to much lower, as defined as visual impairing process.

#### 1. Motility

*Tropia*—a condition in which fusion is interrupted due to a disturbance of coordination of the extraocular muscles of both eyes. Include as a tropia those conditions which are comitant or incomitant, intermittent, near or distant, small angle or large, accommodative or nonaccommodative, secondary to sensory impairment (e.g., cataract, chorioretinitis, optic atrophy, anisometropia), congenital, or acquired.

*Esotropia*—inward deviation of the eyes so that an object in space is not imaged simultaneously on the fovea centralis of each eye.

*Exotropia*—outward deviation of the eyes so that an object in space is not imaged simultaneously on the fovea centralis of each eye.

*Hypertropia*—upward deviation of an eye so that an object in space is not imaged simultaneously on the fovea centralis of each eye; hypertropia frequently occurs in the presence of manifest esotropia or exotropia.

*Comitant tropia*—type of tropia in which there is no apparent muscle weakness and the amplitude of deviation is equal in all cardinal directions of gaze. "A" and "V" syndromes and oblique overactions should be included under comitant strabismus unless clearly of an acquired nature.

*Incomitant tropia*—type of tropia in which one or more muscles or their nervous connections are impaired, e.g., Duane's syndrome, primary or secondary myopathies, cerebral vascular accident, Parinaud's syndrome, blow-out fracture. This is frequently an acquired condition attributable to some other primary cause.

*Phoria*—latent tendency, when fusion is interrupted, for one eye to deviate so as not to look at the same object in space; with binocular fixation this tendency is counteracted by fusional vergence.

*Esophoria*—latent tendency for one eye to deviate inward.

*Exophoria*—latent tendency for one eye to deviate outward.

*Hyperphoria*—latent tendency for one eye to deviate upward.

*Nystagmus*—involuntary, more or less rhythmic, back-and-forth movement of the eyes.

*Pendular nystagmus*—rhythm of movements is regular and approximately equal in both directions; this includes the type found in ocular disease in which central vision either fails to develop or is lost before the age of two years; spasmus nutans (frequently a unilateral nystagmus found in children under two years of age and associated with head nodding); and miner's nystagmus (a fine rapid nystagmus). Exclude voluntary nystagmus.

*Jerk nystagmus*—rhythm of movements is irregular, with slow movement in one direction followed by quick recovery movement in the opposite direction; this includes latent nystagmus (elicited by covering one eye or making the brightness or clarity of retinal images unequal in the two eyes); and end-point nystagmus (when associated with palsies of conjugate gaze, but not when unassociated with disease and begins near the termination of lateral gaze in the abducting eye); and congenital nystagmus.

## 2. Pupils

*Anisocoria*—unequal size of pupils as result of abnormality of iris musculature or its innervation; this would include such diseases as iris melanoma, synechia, tonic pupil, Horner's pupil, colobomas, sector iridectomy, iridodialysis, rubi-osis iridis, corectopia, etc. A sector irregularity will be considered anisocoria.

*Absent direct light reflex*—failure of the pupil to constrict when the amount of light falling upon the eye is increased; this may be the result of iris inflammation, blind eye from retinal or optic nerve disease, central nervous system disorder, etc.

*Absent consensual light reflex*—failure of the pupil of the fellow eye to constrict when the amount of light falling upon the first eye is increased.

Absent light reflex is to be checked only if no iris or pupil change occurs in response to the light challenge.

### 3. Lids

*Blepharitis*—inflammation of the lid margin, characterized by hyperemia, scaling, crusting, suppuration, thickening, and loss of eyelashes. If any of these findings are observed, blepharitis will be considered present.

*Angular blepharitis*—fissuring, scaling, and sogginess of the skin at the outer canthi of the lids, felt to be associated with dietary deficiency of riboflavin or pyridoxine.

Do not include angular blepharitis of infectious nature under angular blepharitis in this study; include this entity with blepharitis.

*Chalazion*—chronic granulomatous inflammation of a meibomian gland which on palpation feels like a small solid nodule within the substance of the lid. Chalazion is usually located on the tarsal portion of the upper lid.

*Concretions*—calcium deposition in cysts of the tarsal conjunctiva of the lower lids. This same finding has been included under conjunctiva as "inclusions." Do not check concretions under lids--include it under conjunctival inclusions.

*Ectropion*—condition in which the lid margin is turned away from the eye so that bulbar and palpebral conjunctivae are exposed. Lid laxity, which returns to normal position after several seconds, should not be included. However, partial or segmental separation of the lid from the globe should be considered ectropion; include spastic, atonic and cicatricial types.

*Entropion*—condition in which the lid margin is turned inward so that the lashes are directed toward the globe. Include atonic, spastic, or cicatricial types as well as minimal or segmental inturning of lid, with or without irritation of the conjunctiva.

*Hordeolum (sty)*—acute suppurative inflammation of eyelash follicles of glands of Zeis or Moll; it may be characterized by localized edema, erythema, and induration, usually along the upper lid margin.

*Ptosis*—condition in which there is drooping of the upper lid causing a narrowing of the palpebral fissure. Ptosis may result from an abnormality of lid musculature, lid innervation, or mechanical interference with lid movement. Ptosis should be checked if there is 1 mm lowering of one lid, or bilateral lowering of both lids to pupil margin. Do not include lid droop resulting from pseudoptosis or enophthalmos in this category. Do not consider a 1 mm difference in lid position which results from proptosis as a ptosis.

### 4. Globe

*Enucleation*—surgical removal of an eyeball; also include in this category evisceration and exenteration, but not anophthalmos.

*Exophthalmos*—forward displacement of the globe; check this diagnosis if Hertel reading is greater than 20 mm in either eye, or if there is 4 mm or more difference between the two eyes (excluding the difference in the two eyes which results from enophthalmos).

*Microphthalmos*—an abnormally small eyeball; corneal diameter of less than



10 mm measured horizontally from the external limbus, microcornea, can be used as criterion of microphthalmos for this study. This condition does not include pthisis bulbi, which should be specified under "other."

## 5. Conjunctiva

*Bitot's Spot*—resulting from vitamin A deficiency is found on the exposed bulbar conjunctiva near the limbus, usually in the area of the temporal palpebral fissure. It appears as a refractible mass with a silvery grey hue and has a foamy surface. This foam, which when rubbed off leaving a roughened conjunctival surface, quickly reforms.

*Conjunctivitis*—any inflammation of the conjunctiva characterized by vessel dilatation. There is frequently a serous or mucopurulent discharge, along with follicular or papillary hypertrophy. In chronic conjunctivitis these signs may be minimal.

*Allergic conjunctivitis*—include vernal, atopic, phlyctenular, and contact conjunctivitis under this category. Allergic conjunctivitis may be characterized by secretion of thick stringy to profuse watery discharge, a follicular or papillary proliferation, pale chemosis, and itching.

*Follicular conjunctivitis*—conjunctivitis characterized by the presence of lymphoid hyperplasia, but to which a specific viral or allergic etiology cannot be applied. In conditions where both papillary and follicular changes are found, record in this section only if follicular hyperplasia is the predominant type.

*Infectious conjunctivitis*—check this entity if the conjunctivitis has the appearance of an infective process, e.g., serous or mucopurulent discharge, but other clinical features do not permit differentiation into bacterial or viral types.

*Bacterial conjunctivitis*—acute conjunctival inflammation associated with mucopurulent discharge; chronic bacterial conjunctivitis found in association with blepharitis may show only congested conjunctival vessels.

*Viral conjunctivitis*—acute follicular conjunctivitis, with pale chemosis, serous discharge, and occasionally preauricular lymphadenopathy or corneal infiltrate.

*Follicles*—this refers to lymphoid hyperplasia of the conjunctiva in which no other evidence of conjunctivitis is manifest. Follicles, which have a white center with blood vessels coursing over it from the periphery, must be differentiated from conjunctival papillae where the blood vessels originate from the center and course peripherally. Follicles are commonly found in most individuals; the presence of one follicle is sufficient for the diagnosis.

*Inclusions*—encysted calcium concretions of the tarsal conjunctiva of inferior fornix; this is synonymous with lid concretions. Inclusions should be checked in preference to lid concretions.

*Pingueculum*—appears as a yellowish-white, slightly elevated, oval-shaped mass on either side of the cornea in the palpebral fissure. This is also a very common finding in most individuals.

*Xerosis*—dryness and hyperkeratosis of the conjunctiva, usually found in children with acute vitamin A deficiency.

## 6. Sclera

*Ectasia*—localized thinning of sclera, through which choroidal tissue may bulge or prolapse.

*Episcleritis*—inflammation of episclera located usually between insertions of the rectus muscles and corneal limbus; it may occur in nodular form with purplish, round-to-oval elevation, a few millimeters in diameter, or as a localized segmental dilatation of episcleral blood vessels.

*Scleritis*—inflammation of sclera, frequently associated with severe pain; it appears as a nodular or gelatinous infiltration of the conjunctiva, episclera, and sclera.

## 7. Cornea

*Arcus senilis*—white arc of peripheral corneal stroma, separated from the limbus by a clear zone; check the appropriate box if even early sector arcus is present.

*Band keratopathy*—subepithelial deposition of calcium in a horizontal line across the interpalpebral cornea; it frequently begins at the limbus, and has the appearance of a grey-white, sometimes opaque, granular band. Include early cases in the diagnoses.

*Degeneration*—refers to changes occurring in the cornea subsequent to aging, inflammation, or systemic disorders (e.g., staphyloma, descemetocele, bullous keratopathy, etc.). Specify the type present.

*Dystrophy*—refers to developmental or inheritable disorders of the cornea (e.g., Fuch's endothelial dystrophy, keratoconus, Meesman's corneal dystrophy, granular, macular, and lattice dystrophies, Salzmann's nodular dystrophy, gutter dystrophy, etc.). Record the type of dystrophy found, if it can be identified.

*Epithelial edema*—microcysts of corneal epithelium resulting from accumulation of fluid.

*Stromal edema*—swelling and haze of cornea due to fluid accumulation in the stroma; has a greyish-white appearance.

*Endothelial K.P.'s*—inflammatory cells adherent to the endothelium in inflammations of the anterior segment of the eye. Occasionally they may be fragmented or brownish in color. Check the appropriate box if even remnants are present. K.P.'s may be confused with pigment granules deposited on the endothelium.

*Guttata*—hyaline proliferations of Descemet's membrane causing displacement of endothelial cells; they occur in the corneal periphery in aging (Hassall-Henle bodies) or centrally (Fuch's endothelial-epithelial dystrophy).

*Keratitis*—any inflammation of the cornea (acute or chronic, active or inactive) resulting from infection, exposure, toxins, allergins, etc.

*Keratomalacia*—desiccation and necrosis of the cornea resulting from vitamin A deficiency. It is a late stage of xerophthalmia, in which the cornea becomes soft, mushy, and opaque.

*Krukenberg's spindle*--vertical deposit of pigment granules on the endothelial surface of the cornea, frequently associated with iris atrophy. Includes early forms where the pigment granules, although not numerous, are deposited in a somewhat vertical configuration.

*Opacity*--any scar occurring in the cornea, from translucent macula to dense leukoma, central or peripheral, anterior or posterior, from any cause, that can be seen with the slit lamp. Exclude superficial stromal opacity which has a separate listing.

*Superficial stromal opacity* --any scar observed in the superficial stroma (outer 1/3) from any cause.

*Pterygium*--triangular growth of vascularized conjunctival tissue that advances progressively over the cornea, usually from the nasal bulbar interpalpebral conjunctiva. Include early forms of the disease where there is beginning encroachment onto the cornea.

*Vessels*--active or inactive fibrovascular growth onto or into the cornea; this also includes small peripheral vessels and ghost vessels.

## 8. Anterior chamber

*Anterior chamber cells*--small opacities in the anterior chamber that can be demonstrated by thin beam of the slit lamp, usually found associated with inflammation of the anterior segment; they should not be confused with free-floating pigment granules frequently found post-dilatation. Check box if four or more cells are visualized per slit lamp field.

*Anterior chamber flare*--translucence of anterior chamber seen with small beam of slit lamp, due to increased protein and fibrin in the anterior chamber. Record if at least 1+ out of a 4+ grading.

*Synechia*--abnormal adherence of iris to contiguous areas of cornea, lens, or vitreous as result of inflammation.

*Posterior synechia*--adherence of iris to lens or vitreous; do not include if pigment granules are present on lens but no synechia visible at time of examination.

*Anterior synechia*--adherence of root of iris to corneal endothelium; do not include iris processes in this category. Presence of one synechia is sufficient to make the diagnosis.

*Atrophy*--patchy areas of light transmission through the iris on transillumination (not including albinism); it may be primary (essential iris atrophy), or secondary (as result of ocular inflammation, trauma, ischemia, glaucoma, etc.), or normal (as in aging). Include early forms of atrophy such as can be found in the pupil margin after dilatation. Iris atrophy is frequently associated with pigment granules on the endothelium.

*Coloboma*--any defect in the iris; it may be congenital or acquired (e.g., from trauma, surgery, or iris atrophy). If coloboma is present, then anisocoria should also have been checked.

*Iritis*—inflammation of the anterior uveal tract; diagnosis made by presence of flare or cell, keratic precipitates, dilated iris vessels, or thickening of iris stromal tissue. Include under this category old inactive iritis (if evidence is present at time of examination) as well as acute or chronic types.

*Neovascularization*—new blood vessel formation on the surface of the iris (do not include dilated blood vessels). New vessels can more commonly be seen at the iris root near the angle.

## 9. Lens

*Aphakia*—the optical condition in which the lens is not in the visual axis, and rays of light are refracted solely by the cornea. Only include under this category those individuals in whom the lens has been surgically removed from the eye. Do not include under this diagnosis any surgical, genetic, metabolic, or traumatic displacement of the lens if the lens still remains within the eyeball; put dislocation under other.

*Cataracts*—a lens opacity consistent with loss of vision, i.e., 20/25 or worse.

*Immature cataract*—minimal to moderate lens opacity in which transparent lens fibers are still present.

*Intumescent cataract*—swelling of lens due to imbibition of water.

*Mature cataract*—entire lens has become opaque.

*Hypermature cataract*—shrinkage of lens.

*Morgagnian cataract*—cortex liquified, and nucleus settled.

*Lens opacity*—any impairment of normal lens translucence (excluding Mitten-dorf dot), whether or not severe enough to cause decrease in vision. Cataracts, which were checked off in the above category, should be included here as well as minor opacities. The lens finding must be large enough to be viewed with the direct ophthalmoscope to be considered as an opacity.

*Anterior polar opacity*—opacity located in the optical axis near the anterior lens surface; the central 20% of the lens surface will be considered axial.

*Cortical opacity*—opacity which occurs within the lens cortex (area between subcapsular and nuclear portion of lens).

*Nuclear opacity*—opacity or decreased lucency of the lens nucleus. Any decrease in the lucency of the lens nucleus will be considered positive.

*Posterior subcapsular opacity*—any opacity occurring in the posterior subcapsular area.

*Pigment on lens surface*—any pigment granules or debris located on the anterior lens surface; this can be found as a result of old iritis, and occasionally without evidence of underlying pathology.

## 10. Vitreous

*Vitreous detachment*—separation of posterior vitreous from retina, seen as a veil that separates the vitreous gel from an optically empty space in front of the retina; check this category if partial or total posterior vitreous detachment is present.

*Vitreous hemorrhage*—presence of any blood or degenerated blood products within the vitreous gel or posterior cavity (if the vitreous is detached).  
*Vitreous opacity (floater)*—translucent specks of various shapes and sizes found in the vitreous, resulting from vitreous detachment and portions of anterior limiting membrane, condensation of vitreous gel, inflammatory cells, or residua of vitreous hemorrhage or inflammation.

## 12. Retina

*Drusen of optic disc (hyaline bodies)*—waxy, pearl-like, whitish irregularities on the surface of or within the substance of the optic disc; it frequently resembles tapioca pudding. Occasionally calcium will be present within the drusen.

*Glaucomatous cup*—for the purposes of this study glaucomatous cup may be considered present when the rim of the cup extends at least to the edge of the disc in any area, along with nasal displacement of blood vessels.

*Neovascularization of the optic disc*—presence of new formed vessels originating from optic nerve head.

*Primary optic atrophy*—characterized by a pale white nerve head with well defined borders, a decrease in small vessels of the nerve head, and visible lamina cribrosa.

*Secondary optic atrophy*—characterized by a pale, frequently greyish appearing disc, with blurred margins.

*Papilledema*—characterized by elevation and erythema of the optic nerve head, congestion and tortuosity of retinal veins, and frequently peripapillary hemorrhages and macular edema.

*Papillitis*—inflammation involving the intraocular portion of the optic nerve, characterized by obliteration of the physiologic cup, obscuring of disc margins, venous dilatation, and occasionally hemorrhages on the surface of the disc and retina. Clinically papillitis may appear similar to papilledema, except that abrupt loss of vision is more characteristic of papillitis.

*Senile macular degeneration*—characterized by loss of macular reflex, pigment dispersion and clumping, and drusen; for this study there must be an associated vision loss of 20/25 or worse (best corrected) felt to be due to this disease.

*Senile disciform macular degeneration*—characterized by choroidal hemorrhage and connective tissue proliferation between retinal pigment epithelium and Bruch's membrane, causing an elevation of the foveal retina. This should be differentiated from disciform degenerations of other causes, e.g., histoplasmosis, toxoplasmosis, angioid streaks, high myopia, etc.

*Senile circinate macular degeneration*—perimacular accumulation of lipid material within the retina.

*Diabetic involvement of macula*—characterized by presence of microaneurysms, hemorrhages, hard and soft exudates, or neovascularization, in an area within 1 disc diameter of the fovea.

*Macular edema*—characterized by loss of foveal reflex and thickening of macular retinal tissue due to accumulation of fluid; occasionally small cysts may be found within the retina substance. Macular edema may result from such causes as trauma, hypotony, venous congestion, prolonged papilledema, etc. It can be best observed by directing the ophthalmoscope light just off to the side of the macula.

*Hypertensive macular involvement*—characterized by presence of edema, hemorrhages, or exudates within 1 disc diameter of the fovea, associated with attenuation or focal constriction of arterioles.

*Pigment epithelial detachment*—presence of serum or hemorrhage beneath the pigment epithelium, as may be found in central serous retinopathy, associated with optic pits, ocular histoplasmosis, etc. Detachment of the neuroepithelium of the retina should be described under "other."

*Arterial branch occlusion*—interruption of blood flow in an arterial branch, secondary to vasospasm, sclerosis, or emboli, characterized by sludging of blood peripheral to the obstruction, giving a pale ischemic retina; exclude cytoid bodies from this category (ischemic infarcts of nerve fiber layer). Include chronic arterial occlusion: the arteries are small, sheathed, or obliterated, and the optic nerve may be atrophic.

*Central arterial occlusion*—resulting from obstruction of blood to the central retinal artery, either permanently or temporarily, giving a pale opaque retina, and occasionally a cherry red appearing fovea; the arteries appear as thin red threads. The blood initially shows sludging but may return after a time; in chronic occlusion the arteries remain narrow and may become sheathed, and the optic nerve atrophic.

*Generalized arteriolar narrowing*—a decrease in size of the arteries, demonstrated by comparison with contiguous veins; a vein:artery ratio greater than 2:1 should be classified as narrowing (in the absence of obvious venous dilatation).

*Arteriolar sclerosis*—a brightening or increased luster of arterioles, mild depression of veins at points of arteriolar crossing and reduction of visibility of veins beneath the arterioles.

*Branch vein occlusion*—characterized by engorgement of a branch of central retinal vein with resulting retinal edema and hemorrhage along the course of the vein; physiologic pulsation of the vein cannot be elicited by pressure on the eye.

*Central vein occlusion*—characterized by engorgement of all branches of the central retinal vein with resulting edema and hemorrhages of the total retina; in healed vein occlusion the veins may become narrowed and neovascularization may result.

*Venous dilatation*—engorgement of veins as result of partial venous obstruction, blood dyscrasias, etc.

*Venous sausageing*—variations in caliber of vein wall, usually found in hypertension; also sarcoidosis.

*Venous sheathing*--white, fibrous-appearing covering of the vein wall, frequently found in inflammation, hypertension, multiple sclerosis, old vein occlusion, etc. One area of sheathing will be considered positive.

*Venous tortuosity*--frequent changes in direction of veins; sometimes found in conditions causing partial or total venous obstruction.

*Capillary microaneurysms*--minute red dots in the internal retinal layers of unchanging appearance and seemingly unrelated to blood vessels. They are most commonly associated with diabetes mellitus, but may be found in conditions causing retinal venous stasis, e.g., Coat's disease, periphlebitis, and hyper-viscosity of the blood. Although difficult to differentiate from small blot hemorrhages, one lesion of typical location, size, and color will be considered positive.

*Capillary neovascularization*--new vessel formation of any type, found in any area of fundus (except that arising from the disc which should be included under disc neovascularization).

*Cotton-wool exudates (cytoid bodies)*--soft, fluffy appearing lesions that occur in inner layers of the retina, resulting from microinfarcts of the nerve fiber layer.

*Hard exudates*--appearance of hard white deposits in the retina.

*Waxy exudates*--appearance of yellow hyaline deposits in the retina.

*Choroidal hemorrhage*--appearance of dark red to slate grey mass beneath the retina; if associated with senile macular degeneration or ocular histoplasmosis, do not include. Small choroidal hemorrhages can sometimes be difficult to differentiate from nevi of the choroid.

*Pre-retinal hemorrhage*--occurs just beneath the internal limiting membrane, and is usually a sheet-like veil that obscures the underlying retina and vessels.

*Deep retinal hemorrhage*--small dot and blot hemorrhages.

*Superficial retinal hemorrhages*--usually flame shaped and taking the configuration of the nerve fiber layer.

*Choroidal pigment changes*--proliferation or disturbance of choroidal pigment e.g., chorioretinitis, trauma, nevi, gyrate atrophy, etc.

*Atrophy of pigment epithelium*--disturbances of pigment epithelium in areas of the retina other than the macula, e.g., albinism, high myopia, etc. Include tapetoretinal degenerations and other peripheral retinal degenerations under "Other pigment changes."

*Hyperplasia of pigment epithelium*--proliferation of pigment epithelium other than that associated with chorioretinitis, e.g., "Grouped pigmentation." Pigment hyperplasia appears black whereas a choroidal nevus has a more greyish-black appearance and is somewhat more obscured by the overlying retina.

*Angioid streaks*--tears in Bruch's membrane, characterized by network of pigmented striations at the choroidal level.

*Retinal detachment*--separation of retina from pigment epithelium, associated either with retinal hole, secondary to mechanical traction, or presence of shifting subretinal fluid. This condition must be differentiated from retinoschisis.

*Drusen*—hyaline excrescences of Bruch's membrane; do not include those drusen found in the macula under this category.

*Chorioretinitis*—inflammation of choroid and retina; specify etiology if possible, e.g., histoplasmosis, luetic, toxoplasmosis, etc.

*Active chorioretinitis*—characterized by presence of retinal edema and exudate, or inflammatory cells in the vitreous.

*Inactive chorioretinitis*—focal or diffuse disruption of choroid or retina resulting from previous inflammation; retinal and choroidal edema and exudate must be absent at the time of the examination.

*Retrolental fibroplasia*—result of ocular exposure in premature infants to high arterial oxygen levels; characterized by the presence of disordered retinal vascularization, fibrosis, and secondary retinal detachment.

## Replicate Testing

### 1. Purpose

- A. To insure accuracy of data
- B. To provide an estimate of repeatability of data
- C. To maintain uniformity of examination procedure

### 2. General plan

The ophthalmology examiner will be observed by either Dr. Garcia or Dr. Ganley during the initial sessions of each stand. The examinations will be replicated, and the examiner evaluated by the observers. Recommendations to the examiner will be made.

### 3. Procedure

The replicate testing will be carried out on the first two sessions of each stand; all examinees at each session will be replicated.

The first part of the examination will be conducted by the observer (simultaneously with the examiner) and recorded on a special replicate form made out for each examinee. The observer need not take his own history unless to clarify a point. Visual acuity and external segment parts of the form can be filled in by observing the examinee's response to the examiner's conduct of the examination. The observer should personally check the lensometer readings.

It is necessary for the observer to take only one tonometry reading; this should be done immediately after the examiner. It is not necessary for the observer to repeat gonioscopy or refraction.

The slit lamp and fundoscopic examination should be done by the observer when the examiner has completed his examination. The observer's evaluation should be made without knowledge of the examiner's results.

In general, check the examiner for technique, facility with the instruments, and adherence to the protocol. Make comments on the last sheet of the observer's form; also note if any specific problems or questions have arisen during the course of the exam. Recommendations to the examiner can be made, if needed, at the end of each session.



At the end of each session, compare the examiner's evaluation of each examinee with the observer's; transfer the data from the examiner's form to the replicate form and check whether agreement is present or not.

In several areas, where measurements are made, agreement can be defined as:

anisocoria	$\pm 1$ mm
tonometry	$\pm 2$ mm (observer with average of examiners')
glasses	
sphere and cylinder	$\pm .25$ diopter
axis	$\pm 10^\circ$
Hertel (base same)	$\pm 1$ mm

In observations written under "Other", judgment will have to be made by the observer as to the "sense" of agreement, rather than absolute agreement.

CHAPTER 10  
PHYSICIAN'S EXAMINATION

General

HANES is designed to gather data for statistical analysis. Rather than have a general clinical examination performed in the manner most familiar to the examining physician, we have a physical examination structured to gather data on physical conditions pertinent to nutrition and certain chronic diseases. This section of the manual, which describes the method of performing the examination and specifies the method of recording findings, should be followed explicitly. This is important because it helps insure that complete and uniform examinations are performed by the approximately 30 examining physicians who will participate in the collection of the data. Other sections of the manual (see Role and Responsibilities of the Examining Physician, Medical Policy Regarding the Examination, and Emergency Medical Procedures) describe the other obligations and duties of the examining physician. Questions unanswered by the manual should be referred to the Medical Officer of the Operations Branch.

Format for The Examination

*Sitting*

Blood pressure and pulse

HEENT

Hair, skin, skull, glands

Ears

Nose

Eyes

Mouth

Neck

Thyroid

Nodes and trachea

Chest (including heart)

Inspect

Auscult

*Reclining*

Heart

Inspect

Palpate

Auscult

Abdomen  
Inspect  
Percuss  
Palpate

Arteries (detailed examination only)

Musculoskeletal (detailed examination only)  
Knee  
Hip  
Straight leg raising

*Sitting*

Extremities  
Lower  
Upper

Neurological  
DTR's  
Chvostek

*Standing*

Musculoskeletal (detailed examination only)  
Back  
Knees

Skin

General appearance and behavior

*Supine and Sitting*

Blood pressure by nurse (detailed examination only)

Examination Procedure

0. *Blood pressure and pulse:* While the examinee is sitting, check his blood pressure and pulse in the right upper extremity. (Count the pulse for at least 30 seconds.)
1. *HEENT examination:* Perform a routine HEENT. Make a special note of characterizing the hair, checking the skin for seborrhea, the skull for bossing, and looking for parotid enlargement. Inspect the external ear and, with an otoscope, examine the auditory canal and tympanic membrane. For

detailed examinees, check each nostril for patency with inspiration during alternate unilateral occlusion and examine each nostril with an otoscope. Check the eyes (lids, conjunctiva, cornea) and mouth (lips, tongue, buccal mucosa) for findings linked with malnutrition—see Folder I on the trailer for illustrations of exemplary findings.

2. *Neck examination:* Observe the neck at rest for thyroid visibility during swallowing of small aliquots of water. Repeat with the neck extended to judge thyroid size and contour. Palpate the neck for thyroid contour and tenderness, lymph nodes, and tracheal deviation.
3. *Chest examination:* Inspect the chest paying particular attention to the skin of the upper back and to the costochondral junctions for signs attributable to malnutrition. Auscult the chest with care to cover representative areas for all lung segments.
4. *Cardiovascular examination:* While the examinee is sitting, and then while he is supine, palpate and auscult the heart. Check especially for cyanosis and venous distention. For the detailed examinees, check the peripheral pulses—note the character of the artery as well as the quality of the pulsation.
5. *Abdominal examination:* Inspect the abdomen for evidence of past surgery and for stigmata of malnutrition. During quiet respiration in the supine position, percuss the liver. For examinees 25 years of age or older, mark the superior and inferior margins of dullness in the midsternal and the midclavicular lines with a ballpoint pen, and measure the liver span to the nearest 1 mm. With the examinee's knees and hips flexed to relax the abdominal musculature, palpate the abdomen.
6. *Musculoskeletal examination:* For the detailed examinees, examine the knees and hips for deformities and signs of inflammation, check for tenderness and for pain with active and passive motion, and perform the straight leg raising test. With the examinee seated, check the legs for calf tenderness and check the extremities for evidence of arthritis and epiphyseal swelling. Also at this time check the extremities for pretibial edema, hyperpigmentation and pellagrous dermatitis, follicular hyperkeratosis, xerosis, mosaic skin, petechiae, and ecchymoses. For detailed examinees, with the examinee standing, check the cervical, thoracic, and lumbar spine for deformities, limited range of motion, and pain with motion by having the examinee flex, extend, laterally bend, and rotate the spine. Check for sciatic notch and sacro-iliac tenderness. With the examinee bending forward (as in touching toes) check for exacerbation or relief of scoliosis (including rotary component). While the examinee is standing, again check the knees for deformities (and the legs for varicosities).
7. *Neurological examination:* While the examinee is seated, test for knee jerks, ankle jerks, and facial spasm (Chvostek Sign).
8. *Dermatological examination:* Check the skin regionally during the other parts of the examination as described previously—see Folder I on the trailer for illustrations of findings linked with malnutrition.
9. *General appearance and behavior:* Take special note of the general appearance and behavior of the examinee which might reflect organic or functional disorders

(e.g., endocrine imbalance, chromosomal disorders, psychosis) which would confound evaluation of nutritional status or reflect malnutrition.

10. *Blood pressure:* At the close of the physician's examination of detailed examinees, the nurse should check the blood pressure while the examinee is in both the supine and sitting positions.

### Recording of Findings

The forms are structured so that they contain information pertinent to "nutrition only" examinees on pages ME-1-3 and to "detailed" examinees (both nutrition and detailed examinations) on pages ME-5-9. The forms contain structured responses, open ended responses, and summaries of diagnostic impressions. Since the structured responses will be used for computer analysis, certain criteria for and/or definitions of these responses will be given below to insure comparability of data collected by numerous physicians. The open ended responses are for recording both common and rare findings (which have not been put into structured form because of rarity or secondary importance to the goals of the survey) so that a more complete medical record will be available if information beyond the structured responses is needed in the future. The summary of findings and diagnostic impressions allows a reviewer to quickly synthesize the physicians' findings on a given examinee and to ascertain the physicians' subjective, as well as objective, evaluations.

Unless otherwise noted in the instructions, positive responses should be recorded with a check, and corrections should be made by circling the response to be negated.

Either the "Findings" or "No findings" box should be checked when they occur. If there are no findings for any section of the examination, check the "No findings" box; if there are findings check the "Findings" box as well as the individual boxes for whatever findings there are.

The letters "R" or "Rt.," "L" or "Lt.," and "B" mean right, left, and both, respectively.

At the end of the chart are forms for reporting findings to physicians. Record there any significant medical findings which need to be reported to a physician or check the box to indicate that there are no significant new medical findings to be reported.

### Criteria and Definitions

#### Nutrition Examination

0. *Pulse and blood pressure:*

Record the pulse as the number of radial pulsations per minute and the systolic and diastolic blood pressure in even digits to the nearest 2 mm. pressure.

## 1. HEENT:

- A. *Dry, staring hair*: Dry, wirelike, unkempt, stiff, and often brittle hair, which sometimes may exhibit some bleaching of the normal color.
- B. *Dyspigmented hair*: Definite change from normal pigment of the hair, most usually evident and best seen by carefully combing hair strands upward and viewing the orderly array of hair in good light. Dyspigmentation includes both change of pigment (usually lightening of color) and depigmentation—not to be confused with dyed or tinted hair. Dyspigmentation is always bandlike in character and is usually associated with some change in texture of hair in the dyspigmented band. In some ethnic groups, particularly Negroid groups, the pigment may be slightly reddish in color. In other, especially among straight black-haired peoples, the bandlike depigmentation ("flag sign") is common. Dyspigmentation is only rarely observed in adults.
- C. *Easily pluckable hair*: A condition in which the shafts of hair are readily removed with minimum tug when a few strands are grasped between the finger and thumb and gently pulled. In such cases there is no reaction from the child, indicating a lack of pain associated with removal of the hair.
- D. *Abnormal texture or loss of curl*: Changes in texture of the hair to a soft, silklike hair. Loss of curl is self-explanatory.
- E. *Circumcorneal injection (bilateral)*: Increase in vascularity by new ingrowth of capillary loops, with particular concentration around the cornea in the absence of obvious causes other than nutrition.
- F. *Conjunctival injection (bilateral)*: Generalized increase in the vascularity of the bulbar conjunctivae in the absence of obvious infection.
- G. *Angular blepharitis*: A fissure located in the lateral palpebral angle of the eyelids which presents as a crack in the epidermis similar to the cracks found at the angles of the mouth in angular stomatitis.
- H. *Xerosis (conjunctivae)*: The conjunctivae, upon exposure when holding the subject's lids open and having the subject rotate his eyes, appear dull, lusterless, and exhibit a striated or roughened surface.
- I. *Bitot's spots*: Small circumscribed, grayish or yellowish-gray, dull, dry, foamy, superficial lesions of the conjunctivae. Seen most often at the lateral aspect of the bulbar conjunctivae of children. Usually bilateral. Not to be confused with pterygium.
- J. *Keratomalacia*: Corneal softening with deformity, either localized (usually central part of lower half of cornea) or total.
- K. *Xerophthalmia*: Xerophthalmia is recorded when the bulbar conjunctiva and cornea are dry and lusterless with a decrease in lacrimation. It is rarely associated with evidence of infection but in extreme cases is associated with keratomalacia.

- L. *Angular lesions of lips*: Record only if definitely present bilaterally when mouth is held half open. May appear as pink or moist, whitish, macerated angular lesions which blur the mucocutaneous junction. Angular lesions are recorded only when there is definite break in continuity of epithelium at the angles of the mouth.
- M. *Angular scars of lips*: Scars at the angles which, if recent, may be pink; if old, may appear blanched.
- N. *Cheilosis*: Different from ordinary chapping. The lips are swollen or puffy and appear as if the buccal mucosa extends out onto the lip. There may be desquamation. This category may be used to include vertical fissuring of the lips. If associated with herpes labialis, note under "other findings."
- O. *Filiform papillary atrophy of tongue*: The filiform papillae are exceedingly low or absent, giving the tongue a smooth or "slick" appearance which remains after scraping slightly with an applicator stick.
- P. *Fungiform papillary hypertrophy of tongue*: The fungiform papillae can be seen and felt when a tongue blade is drawn lightly over the anterior two-thirds of the tongue.
- Q. *Geographic tongue*: Irregularly outlined and distributed areas of atrophy with irregular white patches resembling leukoplakia.
- R. *Fissures of tongue*: Linear lesions or cracks with a definite break in the continuity of the epithelium.
- S. *Serrations or swelling of tongue*: Tooth impressions at sides of tip, often noted when tongue is swollen.
- T. *Scarlet, beefy tongue*: Entire tongue is red, angry in appearance, with or without denudation or fissures. Not just a modification of the natural color due to the loss of papillae. Associated almost always with subjective symptoms of hypersensitivity, burning, and even taste changes.
- U. *Magenta tongue*: A tongue the color of alkaline phenolphthalein.
- V. *Nasolabial seborrhea*: A definite greasy, yellowish scaling or filiform excrescences in the nasolabial area which become more pronounced on slight scratching with the fingernail or a tongue blade.
- W. *Visible enlarged parotids*: Due to difficulties in assessing parotid enlargement, record as positive the presence of bilateral enlargement only if clearly visible.
- X. *Bossing of skull*: Record abnormal prominence or protrusion of frontal or parietal areas.

## 2. Thyroid evaluation:

The World Health Organization (WHO) criteria used for grading goiter are:

*Grade 0*: Persons without goiter. By definition these are persons whose thyroid glands are less than 4 to 5 times enlarged.

*Grade 1:* Persons with palpable goiters. The thyroid is considered to be more than 4 to 5 times enlarged although not visible with head in normal position. Most of these will be readily visible with the head thrown back and the neck fully extended.

*Grade 2:* Persons with visible goiters. Persons with goiters which are easily visible with the head in normal position, but which are smaller than those in Grade 3. Palpation may be helpful in determining the mass of the gland but is not needed for diagnosis.

*Grade 3:* Persons with very large goiters. The goiters of persons in this category can be recognized at a considerable distance. They are grossly disfigured and may be of such size as to cause mechanical difficulties with respiration and the wearing of clothes. (Perez, C., Scrimshaw, N.S., and Munoz, J.A., *Technique of endemic goitre surveys. In endemic Goitre*; p. 369, see esp. p. 376, World Health Organization Monograph Series No. 44, Geneva, 1960.)

*Other thyroid findings:* Record any tenderness, nodularity, enlargement of the isthmus, or other abnormal thyroid findings not included in grading thyroid size.

### 3. Chest evaluation:

A. *Beading of ribs:* A definitely palpable and visible enlargement of the costochondral junctions.

B. *Follicular hyperkeratosis of upper back:* This lesion has been likened to "gooseflesh" which is seen on chilling, but it is not generalized and does not disappear with brisk rubbing of the skin. Readily felt, it presents a "nutmeg grater" feel. Follicular hyperkeratosis is more easily detected by the sense of touch than by the eye. The skin is rough, with papillae formed by keratotic plugs which project from the hair follicles. The surrounding skin is dry and lacks the usual amount of moisture or oiliness. Differentiation from adolescent folliculosis can usually be made by recognition of the normal skin between the follicles in the adolescent disorder. Follicular hyperkeratosis is distinguished from perifolliculosis by the ring of capillary congestion which occurs about each follicle in scorbutic perifolliculosis.

C. *Wheezing on auscultation:* Record any wheezing, inspiratory or expiratory, as focal or diffuse.

D. *Decreased breath sounds:* Record if there is diffusely decreased breath sounds. (Focal or discrete areas of decreased breath sounds should be recorded under "Other findings.")

### 4. Cardiovascular evaluation:

A. *Cyanosis:* Record definite cyanosis which is thought to be related to generalized hemoglobin desaturation. (Focal phenomena, e.g., one extremity cyanotic, should be recorded under "Other findings.")



- B. *Irregular pulse*: Record any irregularities of pulse except physiological variations.
- C. *Cardiac murmur*: Record all murmurs. Grade, location, radiation, and other pertinent description should be given as well as an opinion as to the origin of the murmur.

5. Abdominal evaluation:

- A. *Hepatomegaly*: Record livers palpable 2 centimeters or more below the right costal margin.
- B. *Splenomegaly*: Record all palpable spleens.
- C. *Uterine enlargement*: Record all enlarged uteri including those enlarged secondary to pregnancy.
- D. *Umbilical hernia*: Record all umbilical hernias.
- E. *Potbelly*: Record if abdomen appears abnormally distended and enlarged with due recognition of the usual contour of the young child.
- F. *Masses*: If masses are present, check 054. Record the number(s) of the location(s) (see diagram ME-2 for number of locations) of the mass(es) to the right of 055. Use the number which locates the center of the mass. Check 056 and write in a description of the masses, identifying each by its number location, e.g., (7) 3 cm. diameter firm, fixed, non-tender.
- G. *Scars*: If scars are present, check 057. Record the number(s) of the location(s) of the scar(s) to the right of 058. Use the number which locates the center of the scar. Check 059 and write in a description of the scars, identifying each by its number location, e.g., (7) 3 cm. well-headed appendectomy scar.
- H. *Liver size*: Record liver size in the midclavicular (MCL) and midsternal (MSL) lines to the nearest millimeter on all examinees over age 25. If the lower margin of the liver dullness percussed corresponds to the right costal margin or to the xiphoid tip, use this point for calculation of hepatic span but write ?R (rib) or ?X (xiphoid) to the right of the measurement.

6. Musculoskeletal evaluation:

- A. *Bowed legs (genu varum)*: Bilateral concave deformities of the thighs and tibiae should be recorded, even if mild.
- B. *Knock knees (genu valgum)*: Bilateral convex deformities of the knees and tibiae should be noted only if marked.
- C. *Epiphysial enlargement of wrists*: This can be more easily felt than seen and should be recorded, particularly if present at the ulnar epiphysis.

7. Neurological evaluation:

- A. *Absent knee jerks*: Record bilaterally absent knee jerks—unilateral absence should be described under "Other findings."
- B. *Absent ankle jerks*: Record bilaterally absent ankle jerks—unilateral absence should be described under "Other findings."

- C. *Positive Chvostek sign*: When, in tapping the malar process of the temporal bone on both sides of the face with a percussion hammer, a twitching of the perioral muscles of the same side is elicited, this is a positive Chvostek sign. A positive sign indicates hyperirritability of the neuromuscular system as found in spasmodophilia (tetany) due to calcium deficiency.
- D. *Apathy*: This should be noted and recorded if it is marked, particularly in young children. It has importance in relation to Protein-Calorie Deficiency (PCD).
- E. *Marked hyperirritability*: This refers to behavior (not to reflexes) and should be recorded only if marked.

8. Skin evaluation:

- A. *Follicular hyperkeratosis, arms*: See 3B.
- B. *Hyperpigmentation, hands and face*: Asymptomatic, with no inflammatory component. It is seen most frequently on the dorsum of the hands and lower forearms, particularly when skin hygiene is poor. The skin is rough, dry, and often has a grayish, cyanotic base. There is not the sharp line of demarcation at the border of the lesion such as one sees in pellagra.
- C. *Dry or scaling skin (xerosis)*: Xerosis is a clinical term used to describe a dry and crinkled skin which is made more obvious by pushing the skin parallel to its surface. In more pronounced cases it is often mottled and pigmented, and may appear as scaly or alligator-like pseudoplaques, usually not greater than 5 mm. in diameter. The nutritional significance of it is not established. Differential diagnosis must be made between this condition and changes due to dirt and exposure and ichthyosis.
- D. *Perifolliculosis*: Congestion around the follicles which does not blanch upon pressure. (See discussion of follicular hyperkeratosis above.) There is an early ring of capillary engorgement around some hair follicles which does not disappear on pressure. It is more frequently encountered on the dependent parts such as the legs. Swelling and hypertrophy of the follicles may occur, at which time the skin becomes rough. Follicular hyperkeratosis and perifolliculosis may coexist.
- E. *Petechiae*: Record petechiae which you as a physician judge to be due to abnormalities of the examinee. Do not record normal responses to minor trauma as positives. Qualify by describing distribution and severity, e.g., minimal pigmented purpuric eruption on the legs. If deemed contributory, a tourniquet test may be performed on the upper extremity with the blood pressure cuff adjusted between systolic and diastolic pressures for five minutes, and the results described.
- F. *Mosaic skin*: This is usually found on the lower legs and constitutes a dry, atrophic alteration of the skin with a mosaic-like pattern and a certain luster of the surface. It is associated with conditions where the superficial layers of the skin are subject to stretching (increased tension) due to underlying edema, e.g., in protein deficiency.

- G. *Pellagrous dermatitis*: Areas of dry dermatitis-like lesions on the dorsal surface of hands, cheeks, forehead, and if exposed on the neck (Casals necklace).
- H. *Ecchymoses*: Record ecchymoses which you as a physician judge to be due to abnormalities of the examinee. Do not record normal minor responses to known minor trauma.

9. General evaluation:

Record conditions which might affect normal growth and development or affect the evaluation of nutrition, such as mongolism, cerebral palsy, stroke, dwarfism, parental neglect indicators.

10. Summary of findings:

All examinees receive the nutritional screening evaluation. At the completion of this section of the examination, complete that portion of the physical examination record headed "Summary of Findings." There will be a slight difference in the method of recording between those undergoing solely the nutrition screening evaluation and those adults also receiving the detailed examination.

The examining physician will, in the case of an examinee undergoing only the nutritional screening examination, check either "No findings" or either or both of the headings entitled "Findings Relating to Nutrition" and "Other Findings Not Relating to Nutrition."

Whenever the "Findings Relating to Nutrition" box is checked, briefly summarize the findings. Those checked off in the preceding sections of the examination form from numbers 5-9, 11-20, 22-28, 30, 37, 38, 49, 53, 63-65, 68-72, 75-82, and 93 are considered related to nutrition. These are not to be coded. Under "Other Findings *Not* Relating to Nutrition" category should be listed all other significant conditions which are to be coded as outlined in the previous section of instructions. It is to be pointed out again that the individual examinee may have findings to be listed under both categories. In the case of the examinee who will be receiving the detailed examination as well as the nutrition examination, only the "No findings" or "Findings Related to Nutrition" will be checked with any findings listed accordingly. In this instance, any findings not relating to nutrition will, of course, be listed in the appropriate section on the detailed examination recording form, under "Summary of Diagnostic Impressions."

11. Examiner's subjective impression of nutritional status:

Each examinee, regardless of the type examination, will have the last section in the nutritional screening examination recording form completed. This will be the examining physician's subjective appraisal of the state of

nutrition of the examinee. The physician will indicate whether or not he judges the examinee to have "normal nutrition" or "abnormal nutrition." Obesity is considered to be "abnormal nutrition."

Detailed Examination (in addition to 1-11)

12. External ear:

Record if ears are pierced. Check "Operative scar" only for mastoid operation scars. Check and write under "Other" additional findings which are significant cosmetically and/or which might impair hearing.

13. Auditory canal:

Check "Completely occluded" if there is not sufficient tympanic membrane visible to characterize the membrane under "Drum" (below), and check as "partially occluded" all other cases in which there is obstruction of or protrusion into the auditory canal. For all positive responses, check the cause of the obstruction; write cause under "Other" for causes other than cerumen.

14. Drum:

Check "Not visible" only if "Completely occluded" is checked above. Check as many structured responses as apply in the description of the membrane, e.g., dull, bulging, and fluid may all be checked under R ear. However, do not check two responses for one code number. If the membrane is perforated, check either "With discharge" or "Without discharge." Check "Other" and write in a description if the structured responses need to be supplemented.

15. Nares:

Check "Acute" or "Chronic" if the naris is obstructed (use physical appearance plus history to judge if obstruction is acute or chronic). Check as many responses under "Other Significant Findings" as are necessary to describe the nares.

16. Neck:

Check "Adenopathy," "Tracheal deviation," or "Other" (describe) to describe significant clinical findings (except thyroid findings) in the neck.

17. Chest:

In the structured response chart, check the columns corresponding to the observed abnormalities at the levels of the lobes over which the findings

are observed. (If needed, see diagrams present in the MEC for normal distributions of pulmonary segments and lobes.) Other auscultatory findings, and findings on inspection, percussion, or palpation should be checked and written in under "Other Chest Findings."

18. Heart:

- A. *PMI*: Check whether the PMI is "Felt" or "Not felt." If felt, check the number of the closest interspace and check the relationship to the mid-clavicular line.
- B. *Thrills*: Check whether a thrill is "Absent" or "Present." If present, check systolic and/or diastolic to time the thrill, and check either base or apex to locate the maximum intensity of a given thrill. For multiple thrills, record only the most intense one.
- C. *Heart sounds*: Check the structured response which best describes the first heart sound and the one which best describes the second heart sound.
- D. *Murmurs*: Check "none" if no murmurs are heard. If a murmur or murmurs are heard, place checks under the appropriate period—systolic and/or diastolic—to indicate the timing when categorizing by type and location of the murmur(s) or the component(s) of murmur(s) within each period—systolic and diastolic. When typing systolic murmurs, check "Organic" if any systolic murmur, or systolic component of a murmur, is thought secondary to a cardiovascular lesion; and check "Functional" if no systolic murmur, or systolic component of a murmur, is thought secondary to a cardiovascular lesion. Check "Don't know" only if a reasonable clinical judgment cannot be made. Follow the same guidelines for typing diastolic murmurs. Note that "Functional," "Organic," and "Don't know" are to be considered mutually exclusive responses with each period (systole, diastole). In locating and grading a murmur, record the grade of the murmur by checking the grade, as judged at its point of maximum intensity, in the appropriate period column to the right of the structured location response which best approximates the location of its point of maximum intensity. Unless there are both systolic and diastolic components to a murmur, check only one grade-location response for each murmur; for multiple murmurs, make multiple responses. (However, there should be only one response at a given location within a given period.) To locate the origin of each murmur, or component, thought secondary to a cardiovascular lesion ("Organic" will have been checked), check in the appropriate period column (systolic, diastolic, or both) to the right of the location of the cardiovascular lesion thought to be the origin of the murmur; e.g., for Pulmonic Stenosis check to the right of 097 in the box numbered 1. Make multiple responses for multiple murmurs of "Organic" origin. Check "Other" if the location is other than 94-99, and check "Don't know" if the murmur is thought to be organic but a reasonable clinical judgment of the origin cannot be made.

- E. *Other cardiac and cardiovascular findings*: If there are significant cardiac or cardiovascular findings for which there are no other appropriate responses on page ME-6 or ME-7 (Arterial Evaluation), check "Yes" and then check the structured or open ended (under "Other") response which applies. Check "No" if this space is not needed to describe cardiac or cardiovascular findings.

19. Arterial evaluation:

Check the structured response ("Normal," "Sclerotic," "Tortuous," or "Sclerotic and Tortuous") which best characterizes each artery listed, and check the structured response ("Normal," "Bounding," "Diminished," or "Absent") which best characterizes each pulse listed. If the dorsalis pedis pulse is absent and the posterior tibial pulse is present, check "Absent" for dorsalis pedis and write in "posterior tibial" after "Other" and check its character. If the dorsalis pedis and posterior tibial pulses are both absent, check "Absent" for dorsalis pedis and write in "popliteal" after "Other" and check the character of the popliteal pulse.

20. Joints:

- A. *Knees*: Record knee deformities by checking the appropriate location to the right of the described "Bony irregularity." If there is pain with active or passive motion (or both) or tenderness to palpation, check the appropriate finding(s) to the right of the described location. Since "Diffuse" is sufficient to include locations "Medial" and "Lateral," do not check "Medial" or "Lateral" when "Diffuse" has been checked for any one side (rt. or lt.). Record other knee findings by checking the appropriate location to the right of the description of the findings.
- B. *Hips*: Record "pain on motion" by checking the appropriate location (R, L, Both) within the appropriate columns (active and passive) to the right of the motion which elicits the pain. Similarly, check the appropriate location to the right of any other findings related to the hips.
- C. *Other joints*: To record findings in other joints, locate the square made by the finding to be recorded (i.e., tender, swelling, deformity, limitation, Herberden's nodes, pain on motion, other) and the joint involved. Within that square, check right, left, or both to indicate the location of involvement for shoulder, elbow, wrist, ankle, and feet, and check the *total number* of digits involved on each side for the MP, DIP joints. Check the total number of digits involved on the right and on the left for each finding (note this is the total number of digits involved and not the digit involved).
- D. *Back*: Check the described deformities if observed; check the location of any tenderness or limitation of motion. If there is pain with motion, check the location at the right of the motion which elicits the pain—"Diffuse" should be checked if all three locations (cervical, thoracic, lumbar (low

back)) are involved, but do not check cervical, thoracic, lumbar (low back) in these instances. "Uncertain" should be checked if pain occurs but the site cannot be specified.

- E. *Straight leg raising*: For the SLR test, check negative or positive for both the right and the left. Also, for "Increase with dorsiflexion," check either "Yes" or "No" for both the right and left.

21. Other systems:

Record here system findings which cannot be noted in other parts of the form, e.g., Reticulo endothelial—marked inguinal and axillary adenopathy plus cervical adenopathy, pallor, and petechiae previously noted. But if only petechiae and cervical adenopathy were observed, they would have previously been recorded and need not be recorded here.

22. Blood pressure:

Record the systolic and the diastolic blood pressures to the nearest even digit for both the recumbent and the sitting positions and note the time to the nearest minute of the determination.

23. Summary of diagnostic impressions:

On the last page of the detailed physical examination recording form under the heading "Summary of Diagnostic Impressions" findings should be summarized. Certainly not each and every physical finding should be listed, only those findings considered significant in relationship to disease or certain condition states. It is preferable to summarize findings by condition, such as "osteoarthritis" rather than by listing symptoms or signs. After completing the detailed part of the examination, indicate whether the examinee is "normal" or "abnormal." If abnormal, summarize findings according to the directions briefly outlined above. Cardiovascular (including venous disease), musculoskeletal, and respiratory findings should be listed in their appropriate sections with other findings below.

Following each such listing, indicate the seeming severity of each, checking whether it appears to be either minimal, moderate, or severe. This will be strictly subjective and based on your own appraisal. Should there arise some difficulty in deciding between two of the possible classifications, the lesser of the two should be selected.

Then indicate the certainty of the diagnosis using a scale ranging from 0 to 9 according to the following criteria:

- 0 - not at all certain
- 2 - little bit certain
- 4 - somewhat certain
- 6 - fairly well certain
- 8 - very certain
- 9 - extremely certain

The range, of course, is continuous and any number representing a degree of certainty between two of the listed scale numbers may be selected. When selected, the number should be written in the appropriate space.

Each condition should finally be coded according to the International Classification of Diseases. Since the vast majority of examinees with findings will have one or more of a small number of more common conditions, a listing of the more probable conditions with the appropriate code numbers will be posted within each examining area. Other code numbers for conditions not listed may be found by consulting a complete listing of ICDA codes kept within each caravan.



**CHAPTER 11**  
**BLOOD PRESSURE**

Equipment

Stethoscope  
Sphygmomanometer  
Cuffs - 9.5 cm. and 13 cm.

Procedure

In the detailed examination three blood pressures are to be taken, the first at the beginning of the examination with the examinee sitting, the second at the end of the physician's examination with the examinee supine, and the third immediately after the second with the examinee sitting on the edge of the examination table. The physician takes the first blood pressure; the nurse takes the second and third.

In the nutritional screening evaluation, one blood pressure is to be taken by the physician at the beginning of the physician's examination with the examinee in a sitting position.

In order to standardize the recording of blood pressures, several guidelines are given below. These follow, in general, the recommendations of the American Heart Association (AHA) and are listed in the publication "Recommendations for Human Blood Pressure Determinations by Sphygmomanometers." It is important to remember that despite these attempts at standardization there are several inherent sources of error in the auscultatory method of measuring the blood pressure; these sources introduce a mean error of  $\pm 8$  mm. Hg. into the individual readings regardless of attempts to achieve consistency.

1. The cuff should be at least 20 percent wider than the diameter of the arm. An adult 13 cm. cuff and a pediatric 9.5 cm. cuff are provided. Choice is based on the 20 percent criteria or the cuff which covers approximately two-thirds of the arm. A cuff which is too narrow will give a higher reading.
2. The operator should be at eye level with the manometer.
3. The meniscus should be checked for zero-level calibration each week. This requires simply a check on the meniscus level with an uninflated cuff.
4. The rate of fall should be steady and slow enough to detect the precise levels of first and last sounds. If it is too slow, intermittent trapping of blood occurs between systolic and diastolic levels; a rate of 2-3 mm. Hg. per heartbeat is recommended.

5. Determination of diastolic pressure is a controversial point. The AHA has decided that "the point of complete cessation (of sounds) is the best index of diastolic pressure." If there is no cessation of Korotkoff's sounds, "the point of muffling should be taken as diastolic pressure." Note if muffling was used as diastolic pressure; i.e., 120/70 muffled.
6. Readings should be made to the nearest 2 mm. interval on the measurement scale.

**CHAPTER 12**  
**VENIPUNCTURE**

Equipment

Tech-Mate and cylinders  
Tech-Mate catheter assemblies  
Tourniquet  
Alcohol sponges  
Dry sponges  
Band-Aids  
Lavender top tubes (3cc.)  
Green top tubes (3cc.)  
Red top tubes (15cc.)  
Red top tubes (20cc.)  
Butterfly needles (no. 21 and no. 23)

Venipuncture Procedure

The venipuncture is done either at the beginning of the dermatologist's examination or at some other convenient time during the course of the examination. It is done in the dermatologist's examining area by the nurse with the assistance of the dermatologist or, in certain instances, the examining physician.

The primary area from which the blood is to be drawn is the antecubital fossa; the dorsum of the hand is a secondary site. Cleanse the area with alcohol and apply an appropriately-sized tourniquet proximal to that site. Once the needle is inserted into the vein, release the tourniquet in order to permit free circulation and flow of blood.

Two types of collection are possible—automated collection with the use of the Tech-Mate and manual collection.

1. Automated collection

With this method, the special needle for use with the Tech-Mate is used. Place the appropriate tubes labeled with the examinee's number in the sequence described in the Hematology Procedure Manual in a cylinder and draw the blood. The tubes are changed and filled in sequence automatically. At the end of the blood drawing, withdraw the needle, apply pressure and a Band-Aid to the venipuncture site. Take the cylinder, the data card, and extra number labels to the laboratory.

2. Manual collection

Using the Tech-Mate catheter assembly or a No. 21 or No. 23 Butterfly needle (depending upon the age of the examinee), do the venipuncture in the routine

way; and manually fill and change the required tubes in the same sequence as in automated collection. Put the tubes in a styrofoam holder. At the end of the procedure, withdraw the needle, apply pressure and a Band-Aid to the venipuncture site. Label each tube with the examinee's number and take the tubes along with the data card to the laboratory in the styrofoam holder.

### T<sub>3</sub> and T<sub>4</sub> Handling

#### 1. Procedure

Put 4 ml. of serum into the 5 ml. "mailing tube" and cap the tube. Stick a sample number label on the mailing tube and on the report paper, and write the data on the report paper. Put the mailing tube into the styrofoam mailing holder and keep refrigerated until mailed. The styrofoam holder should be mailed daily to:

Scientia Research Laboratories, Inc.  
429 Westlake North  
Seattle, Washington 98109

#### 2. Replicates

Enough blood for replicate specimens should be drawn (if possible) from all detailed examinees whose sample number ends in 9 and from all who show hyperthyroidism. Draw the extra blood for each replicate by filling two 20-cc. red top tubes instead of one 15-cc. tube and one 20-cc. tube.

Label the replicate with an 800-series number, but otherwise handle it just as the original. Keep a record in the laboratory of the examinee's name, original sample number, and T<sub>3</sub>-T<sub>4</sub> replicate sample number. These records should be sent to headquarters at the end of each stand.

### Hematology

We are equipped to perform a basic hematological examination on blood specimens obtained by a nurse or other qualified person in accordance with the CDC Hematology Procedure Manual. This basic hematology is performed on the day of examination and results become available to the examining physician as soon as conditions permit.

The basic procedures and reporting methods are explained in the Hematology Procedure Manual. Lists of equipment and specifications are also included. It is the responsibility of the HANES laboratory personnel to follow these procedures carefully to insure work of the highest quality and uniformity.

The following tests are performed for each examinee if sufficient specimen is available.

Hemoglobin (cyanmethemoglobin)  
Hematocrit (spun hematocrit)  
Red cell count (Coulter)

White cell count (Coulter)  
Sedimentation rate  
Blood film (sent to CDC)

These tests constitute a basic hematology package that is done entirely in the field facility. All tests, other than sedimentation rate, are performed in duplicate and all results are recorded on a daily work sheet. All clinically borderline results are to be repeated immediately. To facilitate the reporting of any abnormal result the hematocrit should be done before the other laboratory work is completed. This allows the cell indices to be calculated immediately.

Once it has been ascertained that a particular result is abnormal, according to predetermined guidelines prepared by CDC, the laboratory technician should report the result directly to the physician. The technician should also see that an abnormal findings report is initiated when the abnormal result has been verified.

Prior to the shipping of the urine specimen collected for biochemical determinations, the laboratory technician screens specimens for sugar, albumin, and blood and records this information on the daily work sheet along with the hematological results for each examinee.

#### Clinical and Nutritional Biochemistries

The clinical chemistry and Hematology Branch, Laboratory Division, Center for Disease Control (CDC), has established a nutritional biochemistry laboratory where laboratory determinations are performed in support of HANES. CDC has devised the procedures for the collection, identification, processing, and transmittal of the specimens from the field operation to the nutritional biochemistry laboratory in Atlanta, Georgia. The packing and handling of specimens in the field is done by the HANES hematology laboratory in a manner consistent with the greatest protection of specimen integrity and maximum significance of the test results. The processing procedures are explained in the Hematology Procedure Manual prepared by CDC Hematology Branch in conjunction with other components of the CDC Laboratory Division. Thus the validity of the biochemical results is the dual responsibility of NCHS and CDC.

The specific methodology for each test procedure has been worked out by CDC and is consistent with good nutritional laboratory practice and the current state of the laboratory art. The methodology and procedure selected for each individual determination is consistent throughout the duration of HANES.

#### 1. Nutritional biochemistries

Nutritional biochemistries are performed for all examinees for whom a sufficient specimen is available. Five specimen vials are sent to CDC as described in the Hematology Procedure Manual. A 50 ml. urine specimen is also collected

and sent with the five specimen vials in accordance with the prescribed procedure. Specimen allocation is as follows:

- EDTA Vacutainer for all local hematologic examinations;
- Vial 1: 1.0 ml. of serum in ascorbic acid for determination of serum folates;
- Vial 2: 0.5 ml. (500 u1) of heparinized plasma in 2.0 ml. of mPa preservative and precipitant for plasma Vitamin C assays;
- Vials 3, 4, and 5: 3 ml. of pooled, clear serum in each of 3 vials for chemical analyses for nutrition examinees; 3 vials for chemical analyses for nutrition examinees;
- 50 mls. urine--acidified before shipping

If all five specimens and urine per examinee are actually collected and are of a sufficient quantity and quality as determined by CDC, the following nutritional biochemistries are performed:

Serum folate (bio-assay)	Serum cholesterol
Plasma reduced ascorbic acid	Serum magnesium
Serum vitamin A	Urinary iodine (total)
Serum iron	Urinary (creatinine)
Total iron binding capacity	Urinary riboflavin
Total protein and albumin	Urinary thiamin

## 2. Clinical biochemistries

The following clinical biochemistries are performed in addition to the above nutritional biochemistries for all detailed examinees:

- Total bilirubin
- SGOT
- Alkaline phosphatase
- Calcium
- Phosphorus
- Uric acid

**CHAPTER 13**  
**CASUAL URINE COLLECTION**

Procedure

The coordinator (or other staff member) will have the examinee void at the time he is changing clothes. If a urine specimen is not obtained at that time, it will be the coordinator's responsibility to get it during waiting periods. The staff member who changes or assists any child in changing clothes should take that child to the nurse and assist her in attaching the urine collection bag. This same person should then return the child to the waiting area. The nurse (or other staff member) will remove the urine collection bag after having drawn the blood or at the end of the entire examination.

All urine collected will be labeled and taken to the laboratory where the lab technician will do a dip stick test and record the albumin, glucose, pH, and hema-test test results on the laboratory daily work sheet. This test should be done 15 minutes after the collection. The lab technician will then prepare an aliquot, 50 ml. of the urine specimen and one drop of glacial acetic acid, for shipment to the CDC Lab in Atlanta, Georgia. The urine should be shipped frozen in the same shipper as the serum of the examinee.

## CHAPTER 14

### TUBERCULIN SKIN TEST

#### Equipment

One 10cc vial PPD-S tuberculin antigen, 5TU PPD-S/0.1cc  
One 10cc vial PPD-B antigen, Battey series, 5U PPD-B/0.1cc  
Sterile disposable 1cc TB syringes (packed with needle)  
Alcohol sponges  
Dry 2x2 gauze pads

#### Purpose

The nurse administers PPD-B and PPD-S Mantoux tests to each examinee receiving the detailed examination so that we may have presumptive evidence of true tuberculous infection—versus cross reacting atypical mycobacterial infection or noninfection with mycobacteria.

#### Procedure

1. Explain to the examinee the purpose, importance, and procedure of the test. If the individual objects to the test, notify the physician who should use (1) eye tuberculosis and (2) history of violent reaction to previous testing as contraindications. *Note:* a previous markedly positive test *is not* in itself a contraindication.
2. Draw up in one TB syringe 0.10cc of the PPD-S tuberculin and draw up 0.10cc of the Battey antigen in another.
3. Have the examinee sit on the examining table with both volar forearms exposed.
4. Thoroughly cleanse the upper one-third of both volar forearm areas with an alcohol sponge.
5. Holding the forearm skin taut, inject the PPD-S tuberculin intradermally approximately two inches below the anticubital fossa on the volar forearm of the left arm. Then inject the Battey preparation similarly in the right arm. The sites of injection should be in the upper one-third of the forearm over a muscle belly. Hairy areas and areas without adequate subcutaneous tissue, such as concavities over a tendon or bone, should be avoided. Make sure the injection sites are ones that will be obvious when the results are read. A satisfactory test should leave a wheal approximately 8 mm. in diameter. If the test is not satisfactorily given and must be repeated, due to the examinee's jerking, loss of antigen fluid, too deep an injection, or any other problem, choose a second site *below* that of the first and make a note to that effect in the nurse's TB Skin Test Record Book. The small amount of bleeding which may occur at the injection sites a few minutes later may be cleaned with a dry gauze sponge.



6. The skin test must be read by the nurse or an HER 48-72 hours after injection. The extent of induration is the sole criterion for determining reactivity to the antigen; erythema is to be ignored. It is important that the indurated area be measured precisely in millimeters at the widest transverse diameter by thorough palpation and by close examination under adequate light. Reactivity to the test may be suppressed in people who have received concurrent or recent immunization with any live virus vaccine or who are receiving corticosteroids or immuno-suppressing agents.
7. Record all information required (examinee's name and sample number, time and date test given, date to be read, place of reading, and millimeters induration of PPD-B and PPD-S) in the TB Skin Test Record Book, on the TB Skin Test page of the examinee's chart, and on the physician's report sheet. If the test is not administered to a particular examinee, note that on each form and state the reason. For example—"Mrs. Jones had a tuberculin test 1 year ago which resulted in 4 centimeters of skin sloughing and in her physician's instructing her to avoid future tuberculin skin testing."

**CHAPTER 15**  
**BECKMAN DIGICORDER**

**General**

The Beckman digicorder is used in HANES to record spiromograms and electrocardiograms. All data gathered by this unit are recorded on magnetic tapes which are to be forwarded to the Chief, Data Control Section, Headquarters, at the end of each stand.

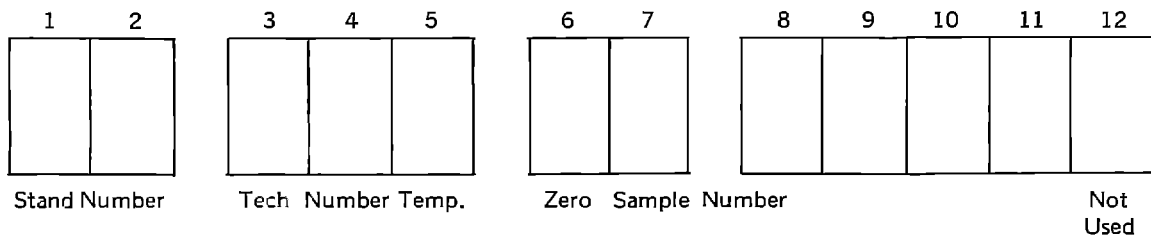
Aside from recording data, the little unit also provides a special coding circuit. The code is a series of rectangular waves which the computer program identifies as the signal code; the recording location; the examinee's identification number, age, sex, race, and height; technician number and a calibration constant.

This calibration constant is the product of the temperature correction factor and the water vapor pressure factor. The constant corrects volumes from ambient temperature and pressure saturated with water vapor (ATPS) to body temperature pressure saturated with the water vapor (BTPS). The code initiates each recording.

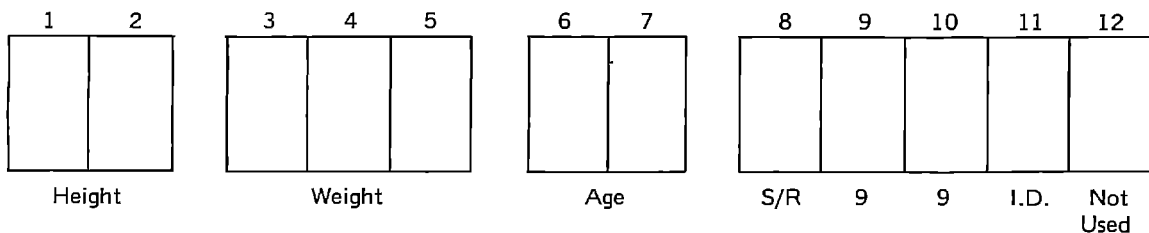
**Code Interpretation**

**Electrocardiogram**

Coded information to be recorded with lead selector switch turned to STD:



Coded information to be recorded with lead selector switch turned to leads 1 through 12:



## Spirogram

Coded information to be recorded with lead selector switch turned to Aux. Lo (calibration) and Aux. Hi (spirogram):

1	2	3	4	5	6	7	8	9	10	11	12
Height		Weight			Age		S/R	9	9	I.D.	Not Used

### Codes

Stand Number:

01-65

Technician Number:

71-99, 01-09. See a current list of technician numbers for any particular one.

Temperature:

8 = 18° C

9 = 19° C

0 = 20° C

1 = 21° C

2 = 22° C

3 = 23° C

4 = 24° C

5 = 25° C

6 = 26° C

7 = no temperature factor or any temperature greater than 26°. Record correct temperature in data book and on examinee's chart.

Sample Number:

First two digits: 01-65 = stand number

Last three digits: 600-799 = examinee number

Height:

01-98 = height to nearest inch

99 = height unknown

Weight:

001-998 = weight to nearest pound

999 = weight unknown

Age:

25-74 = age in years

99 = age unknown

Sex/Race:

- |                  |                  |
|------------------|------------------|
| 1 = white male   | 5 = other male   |
| 2 = white female | 6 = other female |
| 3 = Negro male   | 9 = race unknown |
| 4 = Negro female |                  |

I.D.:

0-9= last digit of sample number

EKG-Spiro Data Book

At the beginning of each stand record the barometric pressure at the top of the page.

On top of each right hand page write the stand number and tape number. Below this make six columns headed respectively: Examinee ID (sticker), Date, Technician, EKG, Spiro, Temp. 27°↑.

On top of each left hand page write "Comments." Record on this page such comments as:

1. Miscoded info on 01999; should be ...
2. Info not coded on 01999; should be ...
3. Canc/PHY (Exam cancelled per physician)
4. Exam not done (or not completed) due to maximum time
5. Exam done on backup unit

Electrocardiogram

1. General

For the electrocardiogram analysis information from twelve leads is recorded on magnetic tape. A computer program has been developed to analyze this information and print diagnostic messages along with the data.

2. Procedure

Record the time on the control record. Put up the table and ask the examinee to lie on his back on the table and make himself comfortable.

A. Place the electrode leads on the examinee.

(1) Place the leads over areas with the least muscle movement (approximately 2 to 3 inches above wrist and ankle joints over medial radius and medial tibia).

(2) Sensitize the areas where limb leads are to be placed by rubbing them lightly with electropads and leaving the pads in place.

B. Turn the selector switch to the STANDARD (STD) position.

C. Enter the examinee's identifying information in the following positions:

1 } Location (stand number)  
2 }

3 } Technician number  
4 }

5 Temperature in °C

6 0

7 )

8 )

9 } Sample number

10 )

11 )

12 Not used

D. Record a standard by depressing the RECORD DATA push button.

E. Change the examinee's identifying information codes to the following:

1 )

2 ) Height to the nearest inch

3 )

4 } Weight to the nearest pound

5 )

6 } Age

7 )

8 Sex/Race

9 9

10 9

11 ID (same as STD)

12 Not used

F. Turn the selector switch to Lead I and record Lead I.

G. Turn the selector switch to Leads II, III, AVR, AVL, AVF in turn and record these leads.

H. Place the chest lead on the examinee:

(1) Sensitize the areas where chest leads are to be placed by rubbing them lightly with the electro pads and leaving the pads in place.

(2) Place the lead on the examinee before turning the selector switch to the position for that lead. Automatic centering is activated by positioning the chest lead before turning the selector switch.

I. Record chest leads, V1, V2, V3, V4, V5, V6.

### 3. Recording

A. The quality of all tracings should be checked in the monitoring oscilloscope before recording.

B. Any lead which has a wandering baseline or a noisy signal should be repeated *except for lead V6*. Leads with wandering baselines or noisy signals will

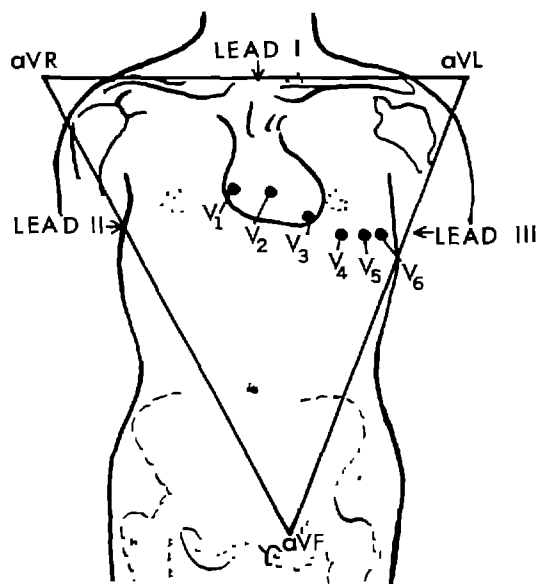
not be computer processed. The computer will process the last recording of each lead.

- C. The maximum vertical distance allowed between the peak of one QRS complex and the next is 3 mm.
- D. If the baseline is wandering, the electrodes should be reapplied using new electro pads; the area should also be frictioned well.
- E. Noise can usually be eliminated by grounding the cart or the bed. The examinee should not be allowed to touch any metal object on or off the bed.
- F. The examinee should be completely relaxed throughout the test. Tense muscles cause a noisy signal.
- G. The electrode clamps should not be too loose because this will cause a high contact resistance that will result in a wandering baseline.
- H. Neither should the clamps be too tight as this will result in muscle tremor.

#### 4. Lead positions

Graphic locations of standard leads (I, II, III), unipolar limb leads (aVL, aVF), and unipolar precordial leads (V<sub>1</sub> - V<sub>6</sub>) with reference to the heart are shown on the following page. *The electrical potential of any extremity is the same anywhere from its point of attachment to the torso to its most distal end.* Therefore, electrodes attached to wrists and ankles will give the same EKG pattern as those placed at the point of union of torso and extremity. The extremity electrodes should be placed over the area where muscle is at a minimum. This prevents picking up muscle potential artifacts. The electrodes should be placed on the inside area of arms and legs, approximately 2-3 inches above ankles and wrists. The electrodes may be moved around to obtain a better recording at the discretion of the technician doing the test.

The electrodes should be cleaned weekly with an abrasive cleanser.



Lead Positions

## Spirometer

### 1. General

The volume output of an electronic spirometer is recorded on magnetic tape. A computer program has been developed that is capable of measuring the forced vital capacity, the forced expiratory volumes at 1, 2, and 3 seconds, the maximum expiratory flow rate, the maximum midexpiratory flow rate, and various peak flow rates for the tape recorded signal.

The examinee, who must stand during the test, is instructed to inhale maximally from room air; then exhale with maximal force and speed into the spirometer. A nose clip, if needed, and a disposable mouthpiece are provided for the examinee.

The important variables that affect the performance of the Forced Expiratory Spirogram (FES) fall into three categories:

- Equipment Function
- Technician Skill
- Examinee Comprehension and Motivation

The section labeled "Calibration Procedure" is designed to help you control the first variable. The second variable refers to the technician's ability to establish initial rapport with the examinee, clearly administer the test instructions, provide the necessary stimulus and motivation for each examinee to perform maximally, and to judge the quality and reproducibility of the spirometry signals. Examinee comprehension and motivation are the end results of technician skill; i.e., the interaction between the technician and the examinee.

Should your best efforts not provide an acceptable test in the limited time of the test module, indicate on the chart and in the EKG Spiro data book that the exam is VOID; and record on the chart your comments concerning the reason for such poor recordings; i.e., language barrier, submaximal effort (SME), inhalation artifact (IH), premature termination (PT).

### 2. Procedure

- A. Turn the lead selector switch to AUX LO. Do not change coding.
- B. Depress the ON button on the storage display unit.
- C. When the screen lights up, depress the ERASE button.
- D. Adjust the settings on the calculator as follows:
  - (1) Move the function switch to the M/P position.
  - (2) Move the select switch to "FVC."
  - (3) Set the controls for the height, age, and sex of the examinee.
- E. Adjust the display meter to zero.
- F. Set the BTPS factor on the calibrator in the spirometer to 000.
- G. Set the BTPS factor on the F/V converter to 0.

- H. Record the spirometer calibration as follows:
- (1) Depress the RECORD DATA push button.
  - (2) Turn the spirometer VOLUME CALIBRATION selector switch from 0 to 5 three times, recording each selection for a minimum of 1 second.
  - (3) Set the spirometer volume calibration selector switch on "Operate."
  - (4) Set the spirometer flow calibration selector switch on "Operate."
- I. Turn the selector switch to AUX HI.
- J. Refer to the regression chart to determine Peak Flow Rate (PFR) and Vital Capacity (VC) cutoff points for each examinee.
- K. Show the examinee how to do the test according to the following instructions:
- (1) "You should be able to blow the ribbon to the top of the column. The faster and harder you blow, the higher the ribbon will go." (Have the examinee watch the Incentive Meter only and explain that it has been set for *his* age, sex, and height.)
  - (2) "Take in a great big deep breath of air." (Have the examinee inhale maximally from room air.)
  - (3) "Hold all of the air in." (Have him hold his breath long enough to insert the cardboard mouthpiece into his mouth while you start the recording.)
  - (4) "Put the mouthpiece into your mouth with your teeth resting lightly on it. Seal your lips tightly around it." (Demonstrate the right way.)
  - (5) "Blast your air into the tube as fast as you can, like a sneeze." (The exhalation should be made with the lips tight around the mouthpiece with maximal force and speed. Do not have the examinee use the nose clip unless he exhales through his nose.)
  - (6) "Keep on blowing out the same breath of air—don't stop, don't take another breath—until you just can't blow anymore or until the ribbon reaches the top of the column. Watch the red line on the meter." (Point to the meter.) "You must get the red line to the top of the meter or as high as you possibly can. The higher, the better."
- L. Demonstrate to the examinee a deep inspiration, proper placement of the mouthpiece, and the bursting of air into the tube. Continue to blow for at least 4 seconds.
- M. Have the examinee do one trial using the oscilloscope as a guide while you record on tape. Watch the examinee closely.
- N. Give additional instructions if necessary.
- O. Proceed with trials 2, 3, 4, and 5 (five trials must be done) making sure that the following requirements are met:
- (1) The onset of the spirogram should occur within 3 seconds after you depress the Record Data button.
  - (2) An optimal baseline should not be less than 1 second or more than 5 seconds in length.
  - (3) The spirogram should not fall at the completion of the examinee's effort. It is a good technique to try to maintain a straight line.



- (4) The computer program demands that the peak of the spirogram be maintained for at least 0.2 second.(5mm.).
- P. Try your best to get the full cooperation of the examinee. Since there is a great deal of voluntary control over respiration, the success of lung-function tests depends on your getting the examinee to actively and fully participate.

(1) Monitoring the volume signal with a strip chart recorder

A clinically acceptable curve must be smooth and free of inhalation artifacts. The extent of the examinee's cooperation should be questioned if successive total volumes vary more than  $\pm 5$  percent for volumes greater than 3 liters or  $\pm 10$  percent for volumes less than 3 liters. This variability can be easily estimated on the oscilloscope by eye and on Sanborn paper in the following manner:

5 percent of 6 liters (30 mm.) is 1.50 mm.

5 liters (25 mm.) is 1.25 mm.

4 liters (20 mm.) is 1.00 mm.

10 percent of 3 liters (15 mm.) is 1.5 mm.

2 liters (10 mm.) is 1.0 mm.

1 liter ( 5 mm.) is 0.5 mm.

(2) Monitoring flow and volume with an oscilloscope

A memory oscilloscope with an X-Y axis is the most precise method of monitoring examinee effort. Flow is registered on the Y axis, and volume on the X axis. Both parameters can be calibrated so that flow and volume readings are read directly from the face of the CRT. Each respiratory effort results in a flow-volume loop. This is displayed on the oscilloscope and compared with subsequent efforts. Discreet changes in examinee effort and cooperation can be monitored by observing the shape of the loop and peak flow deflection. Small variations in respiratory effort cannot successfully be monitored with a volume curve alone.

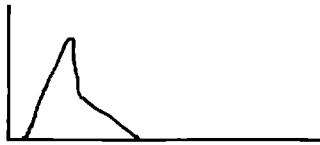
Acceptable spirograms result in reproducible loops. Reproducibility is determined by superimposing one loop over the other or comparing them side by side.

(3) Oscilloscope evaluation

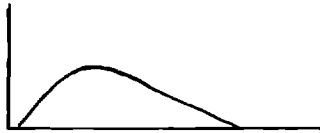
After the examinee has blown into the spirometer and you have watched the FV loop on the screen, evaluate the examinee's effort. If the vertical and horizontal movement of the scribing point of the scope is low or reduced, look for the following conditions in your examinee:

- The mouthpiece not being inserted into the mouth far enough or putting the lips in front of instead of around the mouthpiece.
- Collapsing of the mouthpiece by excessive mouth pressure.
- Tongue occluding the mouthpiece opening.

- (d) Sub-maximal effort due to a lack of understanding of the procedure, reluctance to give a full effort, or improper instructions.
- (e) Inability to comprehend instructions.



Typical flow loop



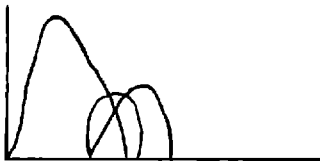
Sub-maximal effort (SME)



Hesitation in initial expiration effort -  
inhalation artifact (IH)



Blowing stopped too soon or mouthpiece  
removed before completed expiration -  
premature termination (PT)

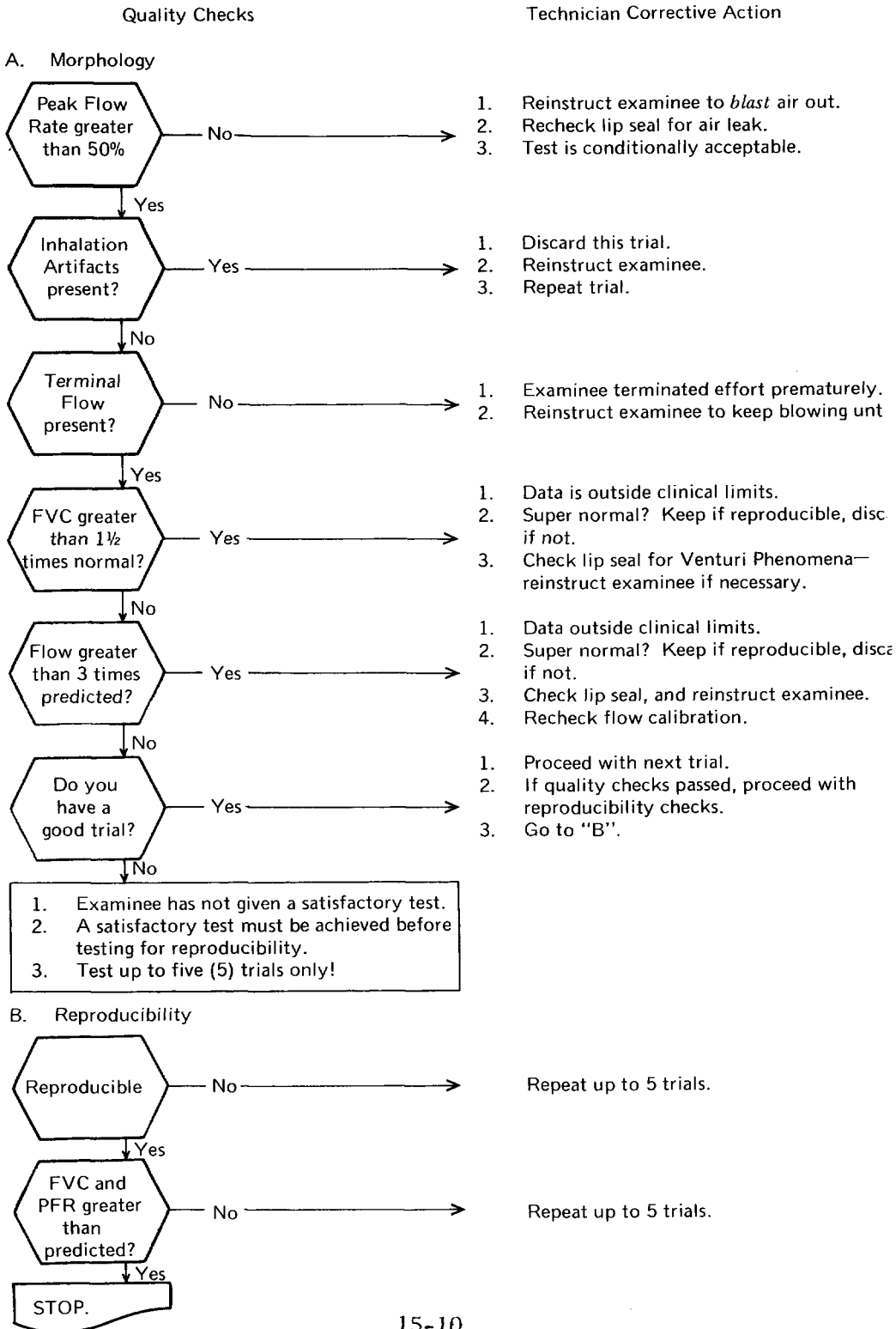


Repeated efforts without removing mouthpiece -  
inhalation artifact (IH)

- Q. If two of the trials are not within the allowable range for both volume and flow rate after five trials, *stop* testing and let the computer decide which two trials are the most comparable.
- R. Label and keep all tracings.
- S. Put the examinee number sticker and note the tape number, date, and any comments in the log book in the order that exams are recorded. Also note in the log book any exams not done, that is, cancelled by the physician.
- T. Label all tapes with the stand number and location, date, and the number of the tape for that stand; e.g., Stand 01, Philadelphia, Pa., Tape 1, 4-27-71.
- U. Send to headquarters at the end of each stand the tapes, the tracings, and

two copies of the log book, one in the box with the tapes and one for the supervisory technician.

3. Quality control procedures



#### 4. Calibration procedure

##### A. Volume

The pneumatic calibration (mechanical) should be checked on a daily basis. Initially, the gain on the pneumatic output is set to give 5.0 liters volume when the calibrator is operating. Using the digicorder chart, record a minimum of 5 consecutive sine waves. The mean of the volume signals should be 5.0 liters,  $\pm 3$  ml. (1 standard deviation) as determined by the computer. A review of the pneumatic volume standard deviation over a month's period will reveal any trend in equipment deterioration; for example, a steady increase in standard deviation.

When pneumatic voltages are known, the electronic calibration for each of the volume positions should be set equal to those voltages at the beginning of each stand using a voltmeter and making necessary adjustments with the proper potentiometer and then checked at the end of each stand. The tracings should be sent to the supervisory technician.

The acceptable magnitude of error is 3 standard deviations. The electronic calibration should be recorded before every examinee.

##### B. Flow

Check the pneumatic flow with the calibrator at the beginning of the stand in the same way as the volume calibration. The mean of the flow signal should be 10.0 liters flow. The tracings should be sent to the supervisory technician.

Flow calibration is not critical as the computer program does not use this signal, nor is it recorded on the digicorder. The flow signal requires merely a minimum adjustment to give the correct deflection on the CRT; i.e., maximum output from spirometer flow channel. The 10 liter/second flow potentiometer in the flow-volume converter should be electronically calibrated by adjusting the output to 10.0 volts (as measured by a voltmeter) at the beginning of each stand.

#### 5. Sterilization procedure

Soak the spirometer hose for at least one hour in cidex aqueous solution and then wash it at the end of each stand and after an examination has been performed on an examinee who has TB or any other active respiratory tract disease.

Remove the front panel of the spirometer and wash the cylinder bore, seal, and piston with cidex aqueous at the end of every third stand. See the spirometer manual for further details.

#### 6. Preparation for transit

The rubber stopper should be inserted into the portal with the piston completely open while the spirometer is in transit.

FORCED VITAL CAPACITY  
80 Percent of Predicted Value

Male

Age range (in years)	Height range (in inches)				
	59-63	64-68	69-73	74-78	79
20-25	3.24	3.85	4.47	5.08	5.33
26-30	3.11	3.73	4.35	4.96	5.21
31-35	3.00	3.62	4.24	4.85	5.10
36-40	2.89	3.51	4.13	4.74	4.99
41-45	2.78	3.40	4.02	4.63	4.88
46-50	2.67	3.29	3.90	4.52	4.77
51-55	2.53	3.18	3.78	4.38	4.66
56-60	2.45	3.07	3.68	4.30	4.56
61-65	2.34	2.96	3.57	4.19	4.44
66-70	2.23	2.85	3.46	4.08	4.33

Female

Age range (in years)	Height range (in inches)			
	55-59	60-64	65-69	70-72
20-25	2.33	2.74	3.16	3.49
26-30	2.26	2.67	3.09	3.42
31-35	2.19	2.61	3.02	3.35
36-40	2.13	2.54	2.96	3.29
41-45	2.06	2.48	2.89	3.22
46-50	2.00	2.41	2.82	3.16
51-55	1.93	2.34	2.76	3.09
56-60	1.86	2.28	2.69	3.02
61-65	1.80	2.21	2.63	2.96
66-70	1.73	2.15	2.56	2.89

Peak Flow Rate

Age range (in years)	80 percent of predicted		50 percent of predicted	
	Male	Female	Male	Female
20-29	9.46	6.14	5.91	3.84
30-39	9.08	5.90	5.68	3.68
40-49	8.71	5.65	5.44	3.53
50-59	8.33	5.40	5.21	3.38
60-69	7.96	5.16	4.97	3.22

## CHAPTER 16

### SINGLE-BREATH DIFFUSING CAPACITY

#### Equipment

Spirometer with 7-liter bell mounted in console  
30-liter box-balloon system and single-breath 5-way valve mounted on console  
Seven push-button panel with seven solenoid valves and associated electric circuitry  
CO meter with relay-rack-mountable control panel with digital readout  
Relay rack version of Collins helium meter with digital readout  
Foot switch to activate kymograph  
Tank of gas mixture containing approximately 10 percent helium, approximately 0.3 percent carbon monoxide, balance air; and reduction valve  
Stopwatch  
Proportional divider  
Metric ruler

#### General

The single-breath diffusing capacity will be measured on all examinees except those who the physician says are medically unable to do this part of the exam.

Because of the need for knowing the examinee's vital capacity before measuring the single-breath diffusing capacity, the spirometry measurements must be taken before the single-breath diffusing capacity.

#### Machine Maintenance and Calibration

1. Before each stand
  - a. Tightly close the metal grid on the left half of the vent over the barometer, and switch off the left half of the vent entirely. Adjust the metal grid on the right half so that the air is directed to the right side of the room. Hot or cold air blowing directly on the barometer will affect the pressure readings.
  - b. Adjust the following switches and leave them for the entire stand:
    - (1) Turn the ON-OFF switch on the back of the machine to ON. Minimal warm-up time is six hours.
    - (2) Turn the CO switch on the CO readout panel to the 3% position.
    - (3) Turn the He ON-OFF switch on the He readout panel to ON.

2. Monthly

- A. Replace the drierite in the back of the machine.
- B. Clean and wash the pens out.
- C. Check the speed of the kymograph with the stopwatch; it should be 32 mm./sec.
- D. Drain the water and rinse out the drum.

3. Daily

- A. Replace the ascerite each morning.
- B. Check the drierite and replace when one-half inch is discolored.
- C. Check the ink level of the pen and make sure it writes.
- D. Place paper on the kymograph and cut sheets for the entire day's exams.
- E. See that the water level of the spirometer is 1 inch from the top.
- F. Check the pressure in the tank; notify the FOM if it's getting low.
- G. Adjust the mercury level on the barometer base so that the ivory tip just kisses the top of the mercury.

4. Before each examination session

A. Fill the balloon.

- (1) Push the RV-BB valve IN.
- (2) Connect the tubing from the gas tank to the CO-IN petcock.
- (3) Open the CO-IN and CO-OUT petcocks.
- (4) Slowly fill the balloon to between one-half and two-thirds full.
- (5) When the gas escape has stopped, close the CO-IN and then the CO-OUT petcock.
- (6) Pull the RV-BB valve OUT.

B. Empty the balloon.

- (1) Turn the 5-way valve to Position 3. Raise the spiro bell.
- (2) Turn the valve to Position 2. Lower the spiro bell.
- (3) Repeat steps 1) and 2) until the bag is empty.

C. Fill the balloon a second time.

D. Fill and flush the system.

- (1) Turn the 5-way valve to Position 1, and remove the side stopper.
- (2) Raise the spiro bell and replace the stopper.
- (3) Turn the valve to Position 2, and lower the spiro bell.
- (4) Repeat steps 1), 2), and 3) until the bag is empty.

E. Fill the balloon a third time.

F. Check the zero and gas.

- (1) Set the pump on Position 4.
- (2) Push the AIR and GAS-PMP buttons.
- (3) Set the flow meter on 400.
- (4) Make all readings with the pump off.
- (5) Adjust the CO and He meter readings to zero and check again.
- (6) Push the INSP and PMP buttons and let the machine run until the numbers stabilize.
- (7) Stop PMP and then run again for a few seconds.
- (8) If the helium reading is within  $\pm 1$  percent of the percentage certified on the tank, change it to read the same as the certified percentage.
- (9) If the CO reading is within 10 percent of 100, change it to read 100.
- (10) If both readings exceed the known percentages by  $\pm 1$  percent and  $\pm 10$  percent, respectively, flush the bag and start over.
- (11) Record the zero, span, and gain settings in the log book.

The gain setting and helium reading should not change from day to day by more than  $\pm 3$  percent. Any larger deviation on any given day suggests that the balloon has been incompletely flushed.

#### Criteria for an Acceptable Exam

*Three trials must be done*, at least two of which must meet all the criteria listed below:

1. Inspiration time must not be longer than three seconds ( $\pm 9.6$  cm.). The only exception to this rule is the case in which all three trials are identical with full examinee cooperation.
2. Breathholding time may not vary more than  $\pm 1\frac{1}{2}$  seconds from the ideal of 10 seconds (32 cm.  $\pm 4.8$  cm.).
3. The volumes inspired must be at least 80 percent of vital capacity as determined by spirometry.
4. There must be a minimum dead space washout of 500 ml.; the ideal is 1000 ml.
5. There must not be any inhalation artifacts.
6. The volume of inspired gas should not decrease more than 200 ml. during breathholding time. A decrease greater than 200 ml. indicates a defective V-valve in the machine.
7. Expired CO and He results should not vary by more than 10 percent between trials.



## Examination Procedure

1. Apply paper to the kymograph drum; overlap right over left and tape.
2. Empty the balloon. This step is *always* required when gas has remained in the balloon for more than one-half hour. It should be done twice at the beginning of an examining day.
  - A. Set the RV-BB valve in the BB position (OUT).
  - B. See that the free-breathing valve is closed ("examinee to room air") (Position 1).
  - C. Move the single-breath 5-way valve to Position 3.
  - D. Gently raise the spirometer bell by hand to near the top. The bottom of the bell must remain in the water. During this maneuver air enters into the mouth opening of the single-breath 5-way valve, proceeds through Siderarm 3 to the box, thereby permitting gas to be removed from the box through the other orifice into the spirometer.
  - E. Turn the single-breath valve to Position 2.
  - F. Gently lower the spirometer bell by manual pressure. Note that air from the spirometer now enters the box and cannot escape the box. Therefore, the gas compresses the balloon which now empties via the one-way V-valve to Opening 2 of the single-breath valve and hence escapes through its mouthpiece. Each time the spirometer bell is depressed, a decrease in the size of the balloon can be seen through the window in the box.
  - G. Repeat Steps C, D, E, and F until the bag is empty, which is signaled by arrest of the descent of the spirometer bell.
3. Fill the balloon.
  - A. Turn the RV-BB valve to the RV position (IN). This must always be done when filling the balloon; otherwise, the pressure within the box will force up the spirometer bell.
  - B. Turn the 5-way valve to Position 1.
  - C. Connect a rubber tubing from a CO tank to the CO-IN petcock on the front of the panel.
  - D. Open both petcocks—CO-IN and CO-OUT—during filling. Opening of the CO-OUT petcock permits air to escape from the box while the balloon is filled. If it is not opened the box or associated tubing will rupture.
  - E. Open the reduction valve on the CO tank. In order to avoid development of excessive pressure in the box, do not permit a flow of more than 10-15 liters/minute. At this rate it will require 2-3 minutes to fill the balloon about half full. The filling can be checked by inspection through the box window. The balloon should be filled until it is well-rounded and its edges touch the sides of the box, but

it should not be filled to the point at which it appears to be under pressure. Meteorological balloons vary somewhat in size but, without pressure, they hold approximately 25-35 liters.

- F. Close the CO tank valve.
  - G. Close the CO-IN valve and wait until no more gas escapes from the CO-OUT valve.
  - H. Close the CO-OUT valve.
  - I. Return the RV-BB valve to the BB position (OUT).
4. Zero the helium and CO meters.
- A. Push the AIR button and the GAS-PMP button. The sampling flow rate produced by the gas pump is now indicated on the flow meter.
  - B. Set the gas pump to Position 4.
  - C. Set the flow meter on 400.
  - D. Allow the GAS-PMP to run until the numbers stabilize.
  - E. Turn the GAS-PMP button off by pushing it a second time. (Note: During all analytical procedures associated with the single-breath procedures, meter readings should be taken while the sample pump is off. When the sample pump is running the pressure in the analytical cells is reduced slightly below atmospheric. Inasmuch as the CO meter reading indicates the total number of molecules of CO within the sample cell, the meter reading will be slightly lower while the pump is running.)
  - F. Set the helium meter reading to  $0.000 \pm 0.002$  with the Zero Adjust knob.
  - G. Set the CO meter reading to  $0.000 \pm 0.002$  with the Zero Adjust knob.
  - H. Push the GAS-PMP button and pump for another 30 seconds. Then repeat the zeroing process.
  - I. If the CO meter cannot be set to zero by means of the zero control, then the internal shutter on the control chamber within the CO meter will have to be changed. (See Section I and directions in the CO meter manual.) The CO meter and front panel CO readings should be the same.
5. Make the inspired gas adjustments.
- A. Push the INS-GAS button and the GAS-PMP button and run the sample pump until the numbers stabilize (30-60 seconds). If the machine takes a long time to stabilize, check:
    - (1) The flow meter (it should be at 400).
    - (2) The ascarite sample tube (discoloration should not exceed a quarter of an inch).
    - (3) The drierite sample tube (discoloration should not exceed one-half inch).

- B. Stop the GAS-PMP and check the readings.
  - C. Repeat Steps A and B.
  - D. If the reading is within  $\pm 10$  percent of 100 unlock the CO meter gain control and turn it until the meter reads exactly 100. If not, repeat Steps 2-5.
  - E. If the reading is within  $\pm 1$  percent of the certified percentage unlock the helium meter gain control and turn it until the meter reads the same as the percentage certified by the gas supplier on the tank. If not, repeat Steps 2-5.
6. Now bring on the examinee.
- A. Flush and fill the system with known gas:
    - (1) Turn the single-breath valve to Position 2.
    - (2) Lower the spirometer bell by manual pressure.
    - (3) Turn the valve to Position 1.
    - (4) Remove the rubber stopper from the examinee's side of the machine.
    - (5) Raise the spirometer bell and replace the rubber stopper. Note: Do not use weights on the spirometer. Always lift the spirometer bell by hand with the free-breathing valve open to permit gas to enter the spirometer. Opening the free-breathing valve and raising the spirometer bell do not contaminate the system because the spirometer is connected only to the box and not to the balloon. Raising the spirometer bell as just described is an essential step. If the spirometer bell is not filled as high as possible with the base submerged in water, then, when the examinee suddenly makes a maximal inspiration the spirometer bell will hit bottom and may crack. Furthermore, water will be sucked into the interior of the spirometer and will run into the box because the RV-BB valve is in the BB position. Such a disaster necessitates the dismantling of the equipment.
  - B. Be sure the balloon has at least 15-20 liters of gas in it (even more if the examinee's vital capacity is greater than 4 liters).
  - C. Be sure the RV-BB valve is in the BB (OUT) position.
  - D. Be sure the spirometer pen is working properly on the paper. Start the pen just left on the paper overlap.
  - E. Set the paper speed to 1920 mm./minute.
  - F. Adjust the height of the single-breath valve to the level of the seated examinee's nose; attach a rubber mouthpiece and insert it in the examinee's mouth. The examinee's neck will be extended upward slightly.

- G. With the single-breath valve in Position 1 do a practice trial in the following way:

Place the nose clip on the examinee's nose and instruct him thusly: "Take in a deep breath. Now blow all the air *all* the way out. When all the air is out, raise one hand or knock on the side of the machine. Now take in a great big breath as fast as you can and hold it. Hold it...hold it...hold it (ten seconds from start to inspiration). Breathe out as fast and as much as you can. Now just breathe quietly."

If the examinee does the trial satisfactorily, proceed with the test.

If the examinee does not do the practice trial satisfactorily, repeat the trial.

- H. Push the BAG-PMP button; wait until the sample bag is entirely evacuated and the tubing is flattened; and then push the OFF button to seal the vacuum in the bag.
- I. Put one foot on the remote kymograph control, one hand on the single-breath valve, and the other hand around a stopwatch.
- J. See that the single-breath valve is in Position 1 and that the examinee is breathing quietly.
- K. Ask the examinee to take in a deep breath, blow *all* the air *all* the way out, and then signal (put a finger up or tap the side of the machine).
- L. At the examinee's signal step on the foot switch to start the kymograph. There should be at least 1 inch of base line before the onset of inspiration.
- M. Turn the single-breath valve to Position 2; ask the examinee to take in a deep breath, and start the stopwatch.
- N. When a full inspiration is achieved as rapidly as possible, encourage the examinee to hold his breath. (As long as the single-breath valve is in Position 2 expiration is prevented by the one-way high V-valve near the balloon.)
- O. When 9½ seconds have passed, quickly turn the valve to Position 3 and tell the examinee to exhale as fast and as fully as possible. After a minimum of 500 ml. has been expelled (about one-half second) turn the valve to Position 4 until the sample bag is nearly full or until expiration has ceased (whichever occurs first). Then return the valve to the original Position 1 and remove your foot from the foot switch.
- P. Take the examinee off the mouthpiece, and remove the nose clip.

Smooth operation of the valve requires some practice. With normal examinees the valve can be turned from Positions 2 through 4; and 4 back to Position 1 in one smooth motion. This will result in an

adequate flush-out and bag sample because of the large volume and rapid flow rate. For examinees with obstructive disease the valve may have to be held in position 3 and 4 for one-half second or more. For examinees with a vital capacity of 1000-1500 ml., several trials may be required. If the vital capacity is less than 1000 ml., it will not be possible to do the test because a minimum of 500 ml. is required to flush out the dead space (of the mouthpiece and valve as well as the anatomical dead space of the examinee), and a minimum of 500 ml. more is required in the bag as a sample for flushing of the sampling circuit and the CO and helium cells. Usually an examinee whose vital capacity is less than 1000 ml. cannot hold his breath for 10 seconds anyway.

7. Analyze the sample.

- A. Push the GAS-PMP button and the BAG button once each and wait until the numbers stabilize.
- B. Stop the GAS-PMP and check the readings.
- C. Repeat Steps A and B.
- D. Press the OFF button for the seven solenoid valves.
- E. Record the CO meter reading on the examinee's chart (Expired CO).
- F. Record the He meter readings on the examinee's chart (Expired Helium Percent).

For examinees with a normal vital capacity, the bag will contain approximately 1500 ml. Since the pump is set for 400 ml./min., pumping for 1½ to 3 minutes should allow for several readings to be taken. If the sample is small (less than 1000 ml.) reduce the pump flow speed to about 300 ml./min. by regulating the flow control at the bottom of the sample CO and He flow tube. Since the volume of tubing, chemical tubes, and CO and He analysis cells is about 300 ml., a reliable reading will not be possible if there are less than 400 or 500 ml. of gas in the bag.

8. Record temperatures and pressure.

- A. Record the Uncorrected Barometric Pressure to the nearest tenth of a mm. of mercury on the examinee's chart.
- B. Record on the chart the room temperature to the nearest degree centigrade from the thermometer mounted on the barometer. Record it in the space to the right of the Uncorrected Barometric Pressure. This temperature is used in the calculation of STP.
- C. Record on the chart the Small Spirometer Temperature to the nearest degree centigrade from the thermometer on the CO tubing system. This temperature is used in the calculation of the ATPS factor.

## Repeat Procedures

1. Do at least three trials that meet the prescribed criteria.

Number each trial at the beginning and the end.

If the criteria are not met in five trials, STOP.

At least 5 minutes should be allowed between trials to assure complete removal of all CO and He from the lung gas. For examinees with marked obstructive disease, it may be wise to wait even a little longer.

2. Repeat Step 5 (inspired gas adjustments) between each trial.
3. Repeat Step 4 (zero setting) if the interval between trials is 10 minutes or more.

Successive tests should agree within 5 to 10 percent provided that the inspired volumes were the same. A small amount of CO is taken up by the bloodstream with each test. Therefore, the blood carboxyhemoglobin saturation slowly rises. As a result, a significant "back pressure" develops after 5-10 tests, depending upon the depth of inspiration, which causes a measurable but small reduction in successive measures of "apparent diffusing capacity."

## Interpretation of Spirogram

1. Data from the spirogram
  - A. Inspired volume (VC ATPS) in ml. This is calculated and recorded on the examinee's chart.
  - B. Breathholding time. This is measured and recorded on the chart in cm. as the distance from the midpoint of inspiration to the onset of gas collection.
  - C. Volume of dead space washout (minimum of 500 ml.). This is not recorded on the chart.
2. Procedure for getting this data
  - A. Set the proportional divider for lines at a 1:2 ratio.
  - B. Extrapolate the base line of the tracing until you reach a point where the line is perpendicular to the peak volume point of the spiro tracing. Small blips at the peak of inspiration should not be interpreted as peak volume as they are due to the inertia of the water in the spirometer.
  - C. Put one arm of the proportional divider at this point and the other at the peak volume point of the spiro tracing directly above. If there is a decrease in volume of more than 200 ml. during breathholding use

- the mean of the volume from beginning to end of breathholding as the peak volume point.
- D. Without altering the divider setting, put one arm on a vertical line at zero and the other arm on the same line above it. Read the number of ml. at this point to get the inspired volume (VC ATPS).
  - E. Without altering the divider setting, turn the divider over and place one arm at the same point on the base line as in C above and place the other on a point directly above.
  - F. Draw a horizontal line from this point parallel to the base line until it intersects the spiro inspiration tracing. This intersection is the one-half inspiration point.
  - G. Draw a vertical line through the small blip at the point where the wash-out tracing ends and collection of gas in the sample bag begins.
  - H. Place one arm of the divider at this point on the tracing and the other arm on the breathholding tracing before the beginning of the dead space washout tracing.
  - I. Check the measurement as in Step D. It must be at least 500 ml.
  - J. Measure the distance from the vertical line (Step G) to the one-half inspiration point with a metric ruler. Make sure the ruler is parallel to the base line. This is the breathholding time in cm. The computer program will divide the cm. results by 3.2 (the paper speed of the kymograph is 32 mm./sec.) to get breathholding time in seconds.
  - K. If inspiration time is hard to determine, extrapolate lines from the major (most constant, longest, and most obvious) section of the inspiration tracing. Zero inspiration is the point at which the extrapolated line intersects the base line. Termination of inspiration is either the point at which the extrapolated line crosses a horizontal line tangent to the total volume peak, or the point at which a normal-looking inspiration curve reaches a peak and levels off with only a slight gradual increase.

#### Optional Check Procedures

1. Checking the tank gas against the balloon gas.
  - A. Completely remove the sample bag from the single-breath valve and from the machine.
  - B. Remove the rubber tubing from the CO-IN petcock and connect it to the sample bag.
  - C. Open the CO tank valve and allow the gas to pass in and through the sample bag, thereby flushing the bag but still retaining a reasonably large sample.
  - D. Close the CO tank valve.
  - E. Seal off both ends of the sample bag.

- F. Remove the tubing from the sample bag.
  - G. Reattach the sample bag to the machine; keep the other end sealed off.
  - H. Push the BAG and GAS-PMP button and allow the machine to run until the numbers stabilize.
  - I. Turn the GAS-PMP off.
  - J. Repeat Steps H and I and then check the readings. The readings obtained with gas directly from the tank should be the same as the readings obtained from inspired gas in the bag.
2. Checking the gas in the tubing and system against the gas in the tank.
- A. Remove the end of the sample bag tubing from the machine inlet.
  - B. Attach one end of a 2-3 foot piece of tubing of the appropriate size to this inlet.
  - C. Attach the other end to the petcock on the 5-way valve, and open the petcock.
  - D. Push the BAG and PMP buttons and allow the machine to run until the numbers stabilize.
  - E. Turn the GAS-PMP off.
  - F. Repeat Steps D and E and check the readings. They should be the same as the readings obtained from the gas in the bag (inspired gas).



## CHAPTER 17

### X-RAY

#### Restrictions

1. No examinee who is known to be pregnant is to have any X-rays taken. This restriction will be noted on the Control Record by the coordinator or by the physician. If not already noted, the technician must ask any female between the ages of 12 and 45 whether she is pregnant.
2. No female under the age of 50 shall have an X-ray of the pelvis taken.
3. The lead shield shall be used when taking all pelvic X-rays.

#### Radiation Badges

Every precaution recommended by the American College of Radiology and the Radiation Surveys of the Caravans by the Radiological Health Division of the PHS is incorporated in our X-ray setup.

Radiation detection badges shall be worn by X-ray technicians during all operating sessions in the Mobile Examination Center. New badges are provided at the beginning of each stand. These badges are for the *optional* use of examining staff in adjacent trailers in areas near the X-ray machine.

At the end of the stand used badges are to be returned to NIH.

#### X-Ray Exposures

Chest: 72" distance upright

PA 10 MAS - 65-75 KVP = 400 MA - 1/40 sec. - 65-75 KV

Lat 20 MAS - 75-85 KVP = 400 MA - 1/20 sec. - 75-85 KV

Bucky 72" distance upright

PA 20 MAS - 75-85 KVP = 400 MA - 1/20 sec. - 75-85 KV

Lat 40 MAS - 85-95 KVP = 400 MA - 1/10 sec. - 85-95 KV

Pelvis: PA Bucky 72" distance upright

200 MAS - 65-85 KVP = 400 MA - 1/2 sec. - 65-85 KV

Knees: AP Bucky 40" distance

30 MAS - 50-75 KVP = 200 MA - 3/20 sec. - 50-70 KV

Hand (detailed examination): 36" distance - AA industrial film

VAN I - 50 MAS - 58 KVP = 100 MA - 1/2 sec. - 58 KV

VAN II - 50 MAS - 59 KVP = 100 MA - 1/2 sec. - 59 KV

VAN III - 50 MAS - 63 KVP = 100 MA - 1/2 sec. - 63 KV

Hand-Wrist (ages 1-17): 30" distance - RP non-screen film

12.5 MAS - 58 KVP = 500 MA - 1/40 sec. - 58 KV

## Procedure

1. Preliminary
  - A. Record the time the examinee enters the X-ray room.
  - B. Note the sample number that has been previously stamped on each record. Put this number in the lead number holder along with the date and an L (which designates left).
  - C. Set X-ray control for correct X-ray exposure.
  
2. Chest
  - A. Place both 14x17 cassettes in the upright cassette holder and put the lead number holders in the upper left corners. Put one cassette in position for the first exposure.
  - B. Position the examinee with his anterior chest pressed against the cassette. Have him rest the back of his hands on top of his hips and roll his shoulders forward. Whenever possible have the examinee take off his jacket or move it to avoid having metal images on the finished radiograph. If the jacket is left on, any metal snaps should be lined up down the center over the sternum.
  - C. Position the X-ray tube 72 inches from the film with the central beam at the midthoracic spine.
  - D. Adjust the videx cone on the X-ray tube so that only the chest area will be exposed.
  - E. Ask the examinee to take in a deep breath and hold it.
  - F. Make the exposure while standing in the darkroom where you can observe both the meters on the X-ray machine and the examinee.
  - G. Have the examinee breathe and relax while you put the other cassette in position for the second exposure.
  - H. Have the examinee stand with his left side to the cassette. Have him extend both arms up and across his forehead and grasp opposite elbows. Make sure his chin is up and that he is in a true lateral position to the film.
  - I. Repeat steps C, D, E, and F.
  
3. PA Pelvis (Hip) X-Ray
  - A. Put a 14x17 cassette in the cassette holder with an 8:1 movable grid. Put the number holder on the left side of the cassette.
  - B. Hang the plumb bob so that it falls freely through the cut out slots on the cassette holder at the center front of the film.
  - C. Stand the examinee on a perfectly level foot stand with his face to the cassette. The foot stand can be leveled by adjusting the legs, using the spirit levels as guides. Align the medial borders of the examinee's feet against the 7-inch block in the center of the stand. (If the stand is not fixed, see that the center of the foot stand is at the midpoint of the film.)

- D. Adjust the lower edge of the cassette so that it is 4 inches below the palpated greater trochanter.
  - E. Adjust the lead gonad shield so that the top of the shield is level with the greater trochanter at the midpoint of the film.
  - F. If the examinee is unable to keep his knees straight, secure a binder or belt snugly around his knees to be sure that they are fully extended.
  - G. Put the radiopaque yardstick down through the cut slots in the cassette holder with the zero end resting on the top of the leveled stool.
  - H. Position the X-ray tube 72 inches from the cassette and direct the central beam through the small metal circle projecting two inches above the top of the gonad shield. In doing so you will direct the central ray to the level of the femoral heads at the midline of the examinee.
  - I. Ask the examinee to breathe in, breathe out, and then stop breathing. Make the exposure from the darkroom while observing both the examinee and the machine dials.
  - J. Have the examinee resume breathing.
4. Knee X-Ray (AP of Right and Left)
    - A. Have the examinee lie or sit on the X-ray table with both legs extended.
    - B. Place a 14x17 cassette crosswise in the Bucky tray with a 12:1 movable grid and place the number holder on it with the appropriate R or L marker on the correct side.
    - C. Place both knees over the cassette with the palpated condyles in the center of the film.
    - D. Adjust the X-ray tube so that it is 40 inches from the film and direct the central ray to the center of the film in the Bucky tray.
    - E. Ask the examinee to bring his toes back and hold very still. Make the exposure from the darkroom while observing both the examinee and the machine dials.
5. Hand X-Ray (Bone Mineral Measurement) (Detailed Examination Only)
    - A. Place a 10x12 Eastman Industrial Type AA X-ray film upon a sheet of lead rubber on the table.
    - B. Have the examinee sit on the stool with his left side to the X-ray table.
    - C. Place the examinee's left hand on the film posteroanteriorly with the fingers neither pressed closely together nor spread widely apart but straight and flat on the film. Rest the forearm flat on the table with the elbow at a 90° angle. The long axis of the forearm should be parallel to the long axis of the X-ray tube to reduce "heel effect." In case of deformity, amputation, or severe arthritic condition, the right hand should be substituted with adequate notation on the film. Remove all watches, bracelets, and rings that are in the area to be X-rayed.
    - D. Carefully place the lead "wrap-around" around the fifth digit making sure it is flat (so as to cast a wide shadow) and its side is vertical.

- E. Place the "phalanx wedge" parallel to the fifth digit, one-half inch from the digit, with the tip of the wedge level with the tip of the digit.
- F. Place the bone-simulating phantom marked "P" at the end of the wedge.
- G. Place the "radius wedge" parallel to the first digit with the tip at a level with the distal end of the radius one-half inch from it.
- H. Place the bone-simulating phantom marked "R" at the end of the wedge.
- I. Place the lead number holder on the film so that it is within one-half inch of the edge of the film but not covering any part of the hand, wrist, wedges, or phantoms.
- J. Center the X-ray beam on the midpoint of the third (middle) metacarpal with the X-ray tube 36 inches from the film.
- K. Ask the examinee to hold still while you make the exposure from the darkroom.
- L. Record the date, sample number, technician number, and any comments on the sheet posted outside the X-ray room.
- M. Put the Ready-Pak X-ray in the box provided in the darkroom.

DO NOT PROCESS.

6. Hand-Wrist X-Ray (Bone Age) Ages 1 through 17

All the bones of the hand, the wrist, and the distal ends of the radius and ulna are to be assessed for bone age and density.

- A. Place an 8x10 Kodak RP Royal Ready-Pak film on the table.
- B. Have the examinee sit on the stool with his right side to the X-ray table. Have the mother of an infant examinee wear a lead apron and hold the child. If it is necessary to hold the child's hand be careful not to cover the wrist area, but hold on to the arm and distal ends of the second, third, and fourth digit so the carpal bones are clearly visible on the X-ray.
- C. Place the examinee's right hand flat on the film posteroanteriorly, with the fingers neither pressed closely together nor spread widely apart, but flat and straight, not cupped, on the film. In case of deformity or amputation of the right hand the left hand should be substituted with adequate notation on the film.
- D. Position the hand and wrist in the center of the 8x10 cardboard film holder on the table, with forearm flat on the table end elbow at a 90° angle. If the hand-wrist area is too large to fit on the film turn the film holder diagonally so that all the bones of the fingers, hand, and wrist will be on film. At least one inch of the forearm should be on the film holder.
- E. Place the phalanx wedge one-half inch away from and parallel to the fifth phalanx. The slim pointed end of the wedge should be perfectly aligned with the end of the distal phalanx of the third digit.

- F. Place the identification number on the film holder, adjust the collimator, position the X-ray tube 36 inches from the film, and center the X-ray beam on the midpoint of the third metacarpal. Ask the examinee to hold still while you make the exposure from the darkroom.
- G. Take the film to the darkroom and record on the control record the time the X-ray procedure was completed.

## Processing

### 1. X-Rays Developed in Trailers

Films (except for the detailed hand X-ray) are to be developed *before* the examinees are released from the trailers so that unsatisfactory films can be repeated.

All X-rays developed in the trailers should be carefully checked by the technician in charge and the physician.

Duplicate the PA and Lat chest X-rays on the Blu-Ray radiograph duplicating printer and process in the X-omat.

Save each examinee's X-rays in an envelope marked with his sample number (copied from the daily appointment schedule). Put both original and duplicate chest X-rays in a 14x17 envelope. Put the knee and hip X-rays in a 14x17 envelope and mark it "knee and hip." If a hip X-ray was not taken, mark the envelope "knee only." Put the bone-age X-ray in an 8x10 envelope.

At the end of the stand, check all X-rays for correct sample numbers on both film and envelope, dates, and R and L identification; and send the film to Headquarters.

### 2. Detailed Hand X-Ray

Send by registered mail at the end of each stand the Ready-Pak films and the shipping list in the box provided to:

George P. Vose  
P.O. Box 23546  
TWU Station  
Denton, Texas 76204

CHAPTER 18  
AUDIOMETRY

1. *Equipment and field check forms*

- A. Soundproof room.
- B. Beltone audiometers. The Environmental Acoustic Research Corp. Laboratory provides two audiometers and two masking generators to each stand. Both are to be *carefully packed* and returned to Bridgeville at the end of each stand. Mark "FRAGILE" and ship prepaid "AIR FREIGHT-SPECIAL DELIVERY" to:

Kenneth Stewart, President  
Environmental Acoustics Research Corp.  
523 Washington Avenue  
Bridgeville, Pennsylvania 15017

- C. Equipment for field checks: Bruel and Kjaer Precision Sound Level Meter (Type 2203), Bruel and Kjaer—Artificial Ear Coupler (Type 4151), Ballantine Voltmeter (Type 302C).
- D. Forms for field checks:
  - Daily checklist for audiometric technician;
  - Weekly field calibration of earphones, masking generators, bone signals, and pad; and
  - Environmental noise survey (per stand).  
(Order supply through FOM).

2. *Instructions for daily check for hearing testing equipment*

Before starting testing each day the audiometers should be checked as follows after turning main switch to the manual position:

- A. Check each frequency of 500-4000 Hertz (Hz) with intensity set at 40 decibels (dB).
- B. Check the intensities in the following manner:
  - (1) Turn the interrupter switch to the ON position.
  - (2) Set the frequency dial on the 2000 Hz tone.
  - (3) Turn the intensity dial slowly from 20 to 60 decibels and back again to zero and listen for scratch, abrupt increases in loudness, or for other extraneous signals and note any that are present in the "Remarks" section. Intensity dial should be held so that no mechanical clicks are heard when intensity steps are changed. Repeat the procedures in (1), (2), and (3) for each earphone.

- (4) Check the appropriate spaces as the phone is checked for intensity increase.
- C. Check the interrupter switch as follows:
- (1) Turn the interrupter switch to the OFF position.
  - (2) Depress the interrupter switch first at the 20-decibel level and then at the 60-decibel level; listen for a smooth onset of tone. Check the appropriate space on Checklist Form if this type of tone is heard. If the interrupter switch is faulty, this performance should be noted in the space provided for the check mark or in the "Remarks" section.
  - (3) The interrupter switch should be depressed in such a way that no mechanical clicks are heard.
- D. Check the wires leading to the earphone and bone vibrator in the following manner:
- (1) While wearing the earphones and with the tone on at 1000 Hz intensity dial at 40dB, shake the wire to each earphone lightly. Listen for scratch, interrupted signal, or any other abnormality. Note any unusual performance in the "Remarks" section.
  - (2) If the tone is interrupted or changes loudness, tighten the set screws holding the earphone cord in the earphone. If this action does not correct the fault, change audiometers.
  - (3) It may be necessary to replace an earphone cord from time to time. This can be done by loosening the set screws in the earphone, unplugging the old earphone cord, plugging in the new cord and tightening up the set screws once more.
- E. The attenuator and frequency dials may slip on the shaft. If this happens, report it under "Remarks" and change audiometers.
- F. Any *failure* of the audiometer in the daily check will be sufficient reason for audiometer replacement.
- G. *Failure of instruments to meet specifications on daily field check*
- When the first audiometer does not meet specifications on the daily field check, do the earphone field calibration for that instrument (See section 3). If it is out of specifications (exceeds or falls below the ANSI tolerance limits by one decibel or more or if there is some other defect), do a check and the field calibration of the earphones on the second audiometer. If neither instrument works properly, call Mr. Kenneth Stewart for instructions at Area Code 412, 683-1620, Ext. 2230. He will indicate which audiometer is to be returned to him.
- If the second audiometer tested is in working condition, send the first audiometer to Mr. Stewart as soon as possible.
3. *Instructions for field calibration of audiometers, masking generators, voltmeters, and other related equipment*

*General.* Field calibration of the earphones and pads for both audiometers, the masking generators, and the voltmeters will be performed at the start of each

stand, weekly during the examination period and at the end of each stand for the equipment in use. Be sure to use the form with the appropriate expected readings for reporting the test results—C, D, E, A, or B calibrator. If the calibration shows the earphones to exceed or fall below (be + or -) the ANSI intensity tolerance limits, a second independent calibration is to be made. The reports on these field calibrations are to be made in duplicate. One copy is to be mailed that day to the Central Office, Miss Jean Roberts; the other is to be mailed that day to Mr. Stewart at the above address (Section 1).

#### A. *Earphone calibration*

- (1) *Precision sound level meter* (Type 2203) (Bruel and Kjaer). To make the meter ready for use:
  - (a) Pull out the large black knob below the meter dial (Function Selector Knob) referred to as Knob 1.
  - (b) Set Knob 1 to "Batt" position.  
(If pointer falls below section marked "battery" on dial, the batteries need to be replaced. See page 26 of Bruel and Kjaer manual for instructions on this.)
  - (c). Turn black knob full counterclockwise, red circle knob full clockwise (Ref. position). Set function knob (Knob 1) to Lin. Refer to microphone *K factor* which is printed on the paper enclosed in the microphone box. Set screwdriver adjustment control (just to the left of black knob on the face of the instrument) to cause the meter (K factor scale) to read a value equal to the K factor of the microphone.
  - (d) Switch Knob 1 to "A-Slow" position.
  - (e) Turn black knob (Knob 2) counterclockwise until 70 on the dial is at the small black dot to the right of the knob.
  - (f) Turn transparent knob with red circle (Knob 3) clockwise until the 60 on Knob 2 shows through the red circle.

#### B. *Operation of the artificial ear* (coupler) (Type 4151) (Bruel and Kjaer).

To make the coupler ready for use in field calibration of the audiometer earphones:

- (1) Screw the artificial ear coupler onto the sound level meter.
- (2) Unscrew the top half of the coupler.
- (3) Remove the protective grid from the microphone cartridge (Type 4132) and screw the special adapter ring onto the cartridge. Then screw the microphone cartridge onto the bottom half of the coupler. Note: *Take great care not to damage the diaphragm.*
- (4) Screw the top of the coupler, which contains the capillary hole, onto the bottom half over the microphone.
- (5) *Remove the capillary pin.*
- (6) Place spring pressure device onto the fitting for it on the baseboard.
- (7) Mount the earphone to be tested on top of the coupler. Make sure that the earphone to be tested rests squarely on top of the coupler.



- (8) Place the platform of the spring pressure device over the center of the earphone. Push down on the arm of the spring loading device until a reading of 0.5 kg. (500 grams) is obtained on the calibrated scale and lock with the retaining screw.
- (9) Insert capillary pin.  
Now the coupler is ready to use for testing the earphone.

### C. Testing the earphones

- (1) Set the audiometer to a frequency of 500 Hz for the earphone under test.
- (2) Set hearing loss dial on audiometer to 60 dB.
- (3) Turn audiometer interrupter switch to "on" position.
- (4) Turn earphone selector switch to position for earphone being tested, 1R - 2L or 1L - 2R.
- (5) Record the meter reading on the field calibration report forms provided. The meter reading at this frequency is determined as in the following example (for the "C" calibrator):

(500 Hz)      Red Circle on      60      dB  
                  Meter needle on      6.5      dB  
                  Actual meter reading      66.5      dB

The expected reading at this frequency is 67.75. The actual reading to be recorded on the report form is 66.5 dB. Since this is within the ANSI tolerance limits of  $67.75 + 3$  dB (64.75-70.75 dB), the earphone in this example is within specifications at this frequency.

- (6) Turn the audiometer to the next frequency to be tested—1000 Hz. Leave black knob of Sound Level Meter at 70 and red circle at 60. Record the meter reading obtained as in the following example (for "C" calibrator):

(1000 Hz.)      The red circle is at      60      dB  
                  The meter needle is at      8.0      dB  
                  Actual meter reading      68.0      dB

Since the expected reading at this frequency is 66.25 and the actual reading is within the ANSI tolerance of +3 dB (63.25-69.25), the earphone in this example is well within specifications at this frequency.

- (7) Continue testing as indicated above at each frequency shown on the field calibration report form. The form gives the setting for the black knob and the red circle to be used at each frequency.

At each frequency, the actual meter reading is the sum of the setting used for the red circle and the reading indicated by the needle on the meter dial taking into account the sign of the latter reading (i.e.; add if positive number, subtract if negative).

- (8) To test the other earphone of the audiometer:
  - (a) Hold the earphone just tested gently with one hand, raise the platform on the spring pressure device slightly, and rotate the latter away from the earphone.

- (b) Lift earphone off coupler.
- (c) *Remove capillary pin.*
- (d) Proceed with steps (d) and (e) of part (1).
- (e) Proceed with steps (6) through (9) of part B.
- (f) Proceed with steps (1) through (7) of part C.

D. *Earphones found to be out of specifications*

- (1) The field calibration report form gives the expected reading at each frequency and the ANSI tolerance limits allowable around that reading. The expected reading was determined for each set of field calibration equipment in Mr. Stewart's Acoustical Laboratory. As indicated on the report forms, it differs slightly for each set of field calibration equipment.
- (2) If Mr. Stewart has replaced a microphone in the field, the calibration equipment is to go back to him for determination of the set of expected readings for the new microphone.

(8). *Signal level (bone vibrator) found to be out of specifications*

The field calibration report form gives the expected reading at each frequency and the tolerance limit around that reading. These readings have been obtained for each Ballantine at Mr. Stewart's Acoustics Laboratory. If the bone signal level at any frequency exceeds the  $\pm 3$  dB tolerance by more than 1 dB the audiometer should be removed from service and immediately returned to Mr. Stewart.

H. *Calibration of 10 dB attenuation pads*

- (1) Place Ballantine voltmeter in operation as in instruction for voltmeter check.
- (2) Set scale knob to 100 mv position.
- (3) Set audiometer to 500 Hz.
- (4) Turn audiometer Channel 1 selector switch to 1BC-2L.
- (5) Insert "phone plug" end of Ballantine voltmeter lead into the "out jack" of the bone oscillator pad.
- (6) Adjust the audiometer hearing level dial to obtain a reading of 10 dB on the *red scale* of the Ballantine.
- (7) Move the Ballantine "phone plug" from the "out jack" to the "in jack" of the 10 dB attenuator pad.
- (8) The Ballantine should now read "*zero*" dB on the *red scale*.
- (9) This completes the bone pad check.
- (10) Turn audiometer Channel 1 selector switch to 1R2L (Leave frequency dial at 500 Hz).
- (11) Place Ballantine "phone plug" lead into "out jack" of right phone 10 dB pad.
- (12) Adjust hearing level dial to produce a 10 dB reading on the *red scale* of the Ballantine.

- (13) Move the Ballantine "phone plug" from the "out jack" to the "in jack" of the 10 dB attenuator pad.
- (14) The Ballantine should now read "*zero*" dB on the *red scale*.
- (15) Repeat steps (10) through (14) with the audiometer channel selector switch on 1L2R.
- (16) *10 dB pads found out of specifications*

The 10 dB pads were manufactured at Mr. Stewart's Acoustics Laboratory and are accurate to within  $\pm 0.3$  dB at 500 Hz. If the readings obtained on the pads are less than 9.7 dB or greater than 10.3 dB use the corresponding pad from the alternate audiometer and notify Mr. Stewart immediately. A new pad will be calibrated and returned.

#### 4. *Instructions for environmental noise-survey*

To be done during the "dry run" before the start of each stand of examinations. One copy of the completed form should be sent immediately to Miss Roberts and one to Mr. Stewart.

For the survey:

- A. Screw the microphone (with protective grid in place) directly onto the fixture on the Bruel and Kjaer instrument (#2203).
- B. Make the Bruel and Kjaer instrument ready for operation as under Earphone Calibration; instructions (1), (a), (b), and (c).
- C. Set Knob 1 to Ext. Filt. slow position.
- D. Set "weighting" switch on the octave filter set to "off" position.
- E. Close both doors to the audiometer room.
- F. Turn off all hearing test equipment.
- G. Set black knob to 70.
- H. Rotate "Frequency Hz" knob to 31.5.
- I. Adjust red circle knob to obtain a meter reading which is somewhat above "0" dB on the meter scale. Read the red circle number and add to it the meter reading. Example:

Red circle on	60
Meter reading	<u>4</u>
Environmental noise level	64 dB at 31.5 Hz

- J. Record the reading on the appropriate form.
- NOTE: The meter reading will fluctuate considerably. Try to estimate an average reading after having observed the meter for a few moments.
- K. Turn "Frequency Hz" knob to 63.
- L. Turn red circle knob to obtain a meter reading as in instruction #9.
- M. Proceed through each octave band 125 Hz... 8,000 Hz.
- N. Under "Comments" explain circumstances, if possible, where environmental noise level exceeds ANSI allowable levels.

## 5. Audiometry testing procedures

- A. *General.* At the beginning of each day, turn on the audiometer at least 10 minutes before performing the daily field check. Leave the audiometer turned on until completion of the day's testing. Do second field check upon completion of testing. Make sure that both doors of the audiometry room are closed when testing.
- B. *Recording.* Use upper left-hand section of form when sample number is even; and use lower left-hand section of the form when sample number is odd.
- C. *Audiometry testing.* Complete air conduction tests for both ears first, then the bone conduction tests in the sequence indicated on the recording form. For any other part of the test that cannot be completed, enter X in the appropriate box and indicate the reason under "Conditions Affecting Test Results." When "defective equipment", "behavior", or "other" conditions have affected all or part of the audiometric test results, record in the space provided the frequencies that are affected, in addition to checking the specific condition. If the examinee does not respond to the 100 dB intensity for air conduction for any one of the test frequencies, record "100+" in the space provided for that frequency for the ear under test; for bone conduction, if no response at 55 dB record "55+."
- D. *Instruction to the examinee.* After entering the beginning time, the audiometer number, and the technician number on the control record, the technician will proceed with the following steps:
  - (1) Detailed instructions should be given examinee to stress the following points:
    - (a) Earphones will be placed by the technician and must not be touched by the examinee.
    - (b) Sounds will be heard in one ear at a time.
    - (c) Sounds will get progressively fainter.
    - (d) Examinee should show when the sound is heard by raising the index finger of his right or left hand depending on the ear in which the sound is heard.
    - (e) Examinee should keep his finger up until the sound is no longer heard.
    - (f) Examinee should raise his finger to the sound even if he just thinks he hears it (because it sounds very faint).
    - (g) During the test eyeglasses, earrings, and chewing gum, also wigs and bobbypins should be removed if they interfere with the proper placement of phones or vibrator. Hearing aids should be removed.
    - (h) Examinees' hearing will be tested first by air conduction then by bone conduction of sound.
  - (2) Examples of detailed instructions (see p. , "Suggested Instructions To Listeners"): "We are going to see how well you can hear some tones from earphones over your ears. The tones will be short, and most will

be faint. You will have to listen very carefully to hear them. If you hear the sounds (no matter how faint) in the right ear (point to the right ear), put up the index finger of your right hand (point to or touch the examinee's right hand). Hold up your finger only as long as you hear the sounds. As soon as the sound goes away put your finger down. Listen carefully when the sound starts to get fainter but even if you just think you hear it keep your finger raised. First you will hear a tone in your (R/L) ear; if the tone seems to be in the opposite ear be sure to let me know."

E. *Conduct of the air-conduction hearing test.* (See p. 18-12, "Suggested Instructions to Listeners")

- (1) Take the examinee into the test room and seat him opposite examiner but facing away so that he cannot see the examiner's movements or the equipment being operated, but so that his signals can be seen by the examiner.
- (2) Close the test room doors.
- (3) Ask examinee if he has any problems which might affect his hearing—colds, earache, etc.
- (4) Repeat the instructions briefly.
- (5) Make sure that the ears are not obstructed with cotton before placing earphones.
- (6) Place the earphones on the examinee, and make sure the earphone opening is over the ear canal and that it has a good seal against the examinee's ear. Red earphone is placed on the right ear; grey on the left. Hair should be pushed away from the ears before earphone is placed.
- (7) Make sure that the audiometer is ready for the test by checking that it is set in the following manner:
  - (a) Power on for at least 10 minutes prior to start of test.
  - (b) Main switch in the manual position; interrupter switch off; output switch at 1R-2L for right ear; 1L-2R for left ear; Masking Generator output selector in OFF position; attenuator pads correctly hooked up.
  - (c) Frequency dial set at 1000 cycles.
  - (d) Intensity dial set at 40 decibels.
  - (e) Earphone indicator on the switch box is turned to the ear being tested first as prescribed by the test form. When the examinee number is even, test the right ear first; use the right-hand column and follow the sequence indicated. When the examinee number is odd, the left ear first; use the left-hand column and follow the sequence indicated there.
- (8) The 1000 cycle tone is introduced to the first ear to be tested at a level of 40 decibels for about 1 second. This should be well within the range of audibility for most examinees and will serve as listening practice.

If the sound is not heard at 40 dB increase the level in steps of 10 dB until the listener signals that he has heard it.

- (9) When the examinee responds, set the intensity dial 10 decibels below the previous stimulus intensity (30 dB) and present the tone for one or two seconds.
- (10) The procedure of dropping the level of the tone in 10 decibel steps with at least one presentation at each level should be continued until no response is obtained.
- (11) Then raise the intensity dial 5 decibels.
- (12) If a response is obtained at this level, the intensity is reduced 10 decibels. If there is no response, raise the intensity 5 decibels. Always descend 10 decibels and count the number of responses at the threshold while ascending in intensity in 5 decibel steps.
- (13) The threshold recorded is the lowest dial reading at which 50 percent or more of the responses are obtained to ascending presentations—that is, 2 out of 3 or 3 out of 5 trials. Below this level less than 50 percent response is obtained and above this 100 percent response is approached.
- (14) Make the proper two-digit entry on the test form. Test other frequencies in the order indicated on the form.
- (15) Repeat the procedure presenting each successive frequency in the order listed on the examination form to the test ear and then shift to the other ear as indicated on the test form until the air-conduction test has been completed for all frequencies and for both ears.

F. *Procedure necessary for threshold accuracy*

- (1) Avoid rhythmic presentation of signals to the examinee. The examinee may respond to the rhythm rather than to the sound. This is especially true of younger persons.
- (2) Avoid a long, draw out search for a threshold which tends to lessen the interest and cooperation of the person being tested and to produce fatigue. If necessary, shift to another frequency and test, then return to the problem frequency later. Note at the bottom of the form any change in the order of the test on the test form.
- (3) Avoid giving visual or auditory cues when the tone is presented; for example, looking at the person each time a tone is presented, or making a click with the interrupter switch, or clicking in the intensity dial.
- (4) Double check the dial reading.
- (5) Check whether the interrupter switch was at "ON" position.
- (6) Avoid activity which will distract the examinee.
- (7) Check the response of the examinee occasionally by leaving the tone off for several seconds and then presenting the tone to see if he is responding consistently.
- (8) Avoid presentation of the test tone for longer than 3 seconds. This may lead to a false response.
- (9) Count only the ascending responses in determining the threshold.

- (10) Avoid being influenced by the threshold obtained for the first cycle tone when obtaining the threshold for the second presentation of this tone.
- (11) Make sure all forms are complete. Record the time the test is finished and the technician number on the control record. When the test is not done or incomplete, record reason.

G. *Conduct of bone-conduction hearing test*

Instructions to the examiners. (See p. 18-12, "Suggested Instructions to Listeners")

- (1) Placement of the bone conduction vibrator and masking phone.
  - (a) At the termination of the air conduction test, the earphones should be removed from the subject's head. The bone conduction vibrator and headband should be placed on the subject's head with the vibrator resting on the post auricular prominence of the mastoid process so that it makes firm contact and tends to remain in place without sliding.
  - (b) Care should be taken that the vibrator does not touch the pinna, and that there is no hair interfering with the contact of the vibrator with the skin surface. If it slightly touches ear, place gauze gently between.
- (2) Placement of the masking phone.
  - (a) After the vibrator has been properly positioned for the ear under test, the earphones are placed on the subject's head.
  - (b) The blue (left) earphone should always be used as the masking phone when testing each ear.
  - (c) This phone should be placed so that the earphone cushion is positioned directly over the ear to be masked. The other phone is positioned in front of the ear being tested and resting on the cheek.
  - (d) Care should be taken that headband of the bone vibrator does not contact the headband of the earphones. Insert a pad of gauze or foam rubber between headbands if they touch.
- (3) Settings for the audiometer.
  - (a) The narrow-band masking unit is utilized in this portion of the test. The unit should be turned on at the same time as the audiometer and instructions from the original manual should be followed as to warm-up procedures and field listening tests.
  - (b) The controls on the audiometer are set similarly to the standard air-conduction test with the exception that the output control is placed in the 1B-2L position. Frequency of the tone signal to be presented by the bone conduction vibrator is selected on the same dial as for air-conduction testing. Level of the signal is determined on the Channel I attenuator.

- (c) The narrow-band masking unit is set in the following manner:
- (1) The output selector is changed from the *off* position to the *left phone* position. In this mode, the narrow-band masking noise is delivered to the left (blue) earphone.
  - (2) The noise band centering on the frequency to be tested is selected with the "Center Frequency" dial and must be changed to match the test tone frequency each time the test tone is changed.
  - (3) The level of the masking to be used is determined in the following manner:
    - (a) From data obtained during the air-conduction test, note the threshold obtained for the non-test ear of the frequency to be tested. Thus, for example, if testing the bone-conduction threshold at 500 Hz for the right ear, identify the previous air-conduction threshold at 500 Hz for the left ear.
    - (b) To this threshold value add 30 dB. Thus, if the non-test ear threshold for 500 Hz was 10 dB in the previous air-conduction test, the total amount of masking to be used in that ear at 500 Hz would be 40 dB. This amount of masking would then be set on the Effective Masking dial of the narrow-band masking unit. Determine threshold in the test ear. Then increase masking in non-test ear to 40 dB above threshold and again determine threshold in test ear. Then increase masking in non-test ear to 50 dB above threshold and again determine threshold in test ear.
    - (c) Masking levels to be employed at other frequencies would be determined in the same way.

NOTE 1: Masking levels for all frequencies except 500 Hertz may not exceed 90 dB; at 500 Hertz, may not exceed 80 dB.

NOTE 2: Should the listener report that he hears the tone in the non-test (masked) ear, continue to determine threshold as instructed but note this on the form by adding R or L to the hearing level recorded on the form to indicate lateralization.

NOTE 3: Where the hearing level of the non-test ear is *65 dB or greater* omit the masking in bone-conduction testing. If the air threshold is 45-60 dB do only the levels of masking possible (e.g.; if 45 dB, mask at 75 and 85 dB; if 50 dB, mask at 80 and 90 dB; if 55 dB, mask at 85 dB; and if 60 dB, mask at 90 dB).



## SUGGESTED INSTRUCTIONS TO LISTENERS

### 1. *Air conduction*

- A. We are going to test how well you can hear tones.
- B. The tones will be short, and most of them will be faint.
- C. Some tones will be fainter than others.
- D. When you hear a tone, no matter how faint it is, raise a finger (demonstrate) to show that you hear it.
- E. Use your right hand when you hear tones in your right ear and your left hand when you hear tones in your left ear.
- F. When the tone goes away lower your finger.
- G. First you will hear the tones in your (*R/L*) ear (point).
- H. But if the tone seems to be in this ear (point to non-test ear), please tell me.
- I. Remember to raise your finger when you hear one; lower it when you don't.
- J. Do you understand? (If not, clarify as necessary.)

*When AC masking is required.* (Use on better ear - only when HL (*R-L*) or (*L-R*) is 40 dB or more.)

- (1) Now you will hear the tone in your (*R/L*) ear (point).
- (2) At the same time you will hear a noise, like wind, in your other ear (point).
- (3) The noise is to keep you from hearing the tone in that ear, so try not to pay attention to it.
- (4) Listen for the faint tone in your (*R/L*) ear (point) and raise your finger whenever you hear the tone.
- (5) Do you understand? (If not, clarify as necessary.)

### 2. *Bone conduction*

- A. In this test you will hear the same kinds of tones as before (when AC masking not required).
- B. You should hear the tones first in your (*R/L*) ear (point).
- C. At the same time you will hear a noise, like wind, in your other ear (point).
- D. The noise is to keep you from hearing the tone in that ear, so try not to pay attention to it.
- E. Listen for the faint tone in your (*R/L*) ear (point).
- F. But if the tone seems to be in this ear (point to non-test ear), please tell me.
- G. Remember, raise your finger when you hear the tone, *not* the noise, and lower it when the tone goes away.
- H. Do you understand? (If not, clarify as necessary.)

NOTE: If examinee has a hearing aid, test without aid.

- (3) If in two of the independent calibrations the actual reading for the ear-  
phone under test is found to be one or more decibels above or below  
ANSI specifications ( $\pm 3$  dB) place the alternate audiometer in use and  
immediately return the defective audiometer to Mr. Stewart.

#### E. *Masking generator calibration*

- (1) Set up Bruel and Kjaer field calibrator as for earphone calibration  
(Steps (a) and (b) of earphone calibration, Item (1).
- (2) Set knob 1 to "C-slow" position.
- (3) Turn masking generator "left-off-right" switch to *left* position.
- (4) Set masking level knob to 60 dB.
- (5) Set masking center frequency to 500 Hz.
- (6) Set black knob and red circle (on the Bruel and Kjaer meter) to 80.
- (7) Read the masking signal level as in the following example:

Red circle on	80	dB
Meter needle on	<u>2.4</u>	dB
Actual signal level	82.4	dB

The expected reading at this frequency is 81.7. The actual reading to be recorded on the report form is 82.4. At this writing there is no ANSI specification for the tolerance limit for the masking generator signal. For this study a limit of  $\pm 3$  dB (same as pure tone limit) has been chosen. In the above example the masking generator is within the tolerance limit.

- (8) Turn the masking generator to 1000 Hz center frequency and proceed as in the above example using the appropriate expected readings listed on the report form. Note that the masking level, black knob and red circle values change with frequency tested.
- (9) Continue and obtain readings at 2000 Hz and 4000 Hz center frequencies.
- (10) *Masking generators found to be out of specifications*

The field calibration report form gives the expected readings for the masking generator at each center frequency and the tolerance limits allowable around that reading. The expected reading was obtained for each set of field calibration equipment at Mr. Stewart's Acoustical Laboratory. If the masking signal level is found to exceed the  $\pm 3$  dB tolerance limit by more than 1 dB the alternate masking generator should be field calibrated and placed in use. Immediately, send the defective masking generator to Mr. Stewart.

#### F. *Ballantine voltmeter (type 302-C) check*

- (1) Turn meter function switch to BAtt position. The meter should read no less than 19 dB on the *red scale*. If meter reading is less than 19 dB, replace batteries before proceeding.

- (2) Turn "scale" knob to 1 volt range.
- (3) Turn damping switch to "lo damp."
- (4) Insert "banana plug" into voltmeter terminals making *certain* that the *shield* part of the lead is in the ground terminal of the voltmeter.
- (5) The Ballantine is now ready to proceed with bone signal level calibration.  
CAUTION: Ballantine scale changes at the different bone frequencies.

G. *Signal level calibration of bone vibrator*

- (1) Set Channel 1 signal selector switch to 1BC-2L.
- (2) Turn Hearing Level dial to 40 dB.
- (3) Turn tone interrupter switch to continuously "on" position.
- (4) Set frequency dial to 500 Hz.
- (5) Insert "phone plug" end of the lead from the Ballantine voltmeter into the "out" jack of the 10 dB bone pad.
- (6) Record the Ballantine meter reading, in dB, obtained from the *red scale* of the Ballantine meter. For example:

Ballantine meter reading	5.4 dB
Expected reading	<u>6.0 dB</u>
Bone signal	-0.6 dB

For this study the arbitrary tolerance limit is  $\pm 3$  dB around the expected reading of 6.0 dB. In this case the bone signal level is within specifications since it is only 0.6 dB from the expected reading.

- (7) Turn audiometer frequency dial to 1000 Hz and read the Ballantine as above (step (6)). Record the meter reading and continue for the 2000 Hz and 4000 Hz frequencies. Note that the scale knob of the Ballantine alternates from 1 v to 100 mv.

Daily Checklist for Audiometric Technicians

Audiometer Number \_\_\_\_\_ Date \_\_\_\_\_ Stand No. \_\_\_\_\_  
 Location (city) \_\_\_\_\_  
 Technician (sign) \_\_\_\_\_

A. Check each frequency with intensity set at 40 dB.	500		1000		2000		4000	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
Right earphone								
Left earphone								
Bone vibrator								
Masker—left earphone								
B. Check intensities: Frequency at 2000 Hz Increase intensity slowly from 20 dB to 60 dB.	Right earphone				A.M.		P.M.	
	Left earphone				A.M.		P.M.	
	Bone vibrator				A.M.		P.M.	
	Masker—left earphone				A.M.		P.M.	
C. Check interrupter at 20 dB and 60 dB. No. clicks present	A.M.							
	P.M.							
D. Check wires at 1000 Hz intensity dial at 40 dB.	A.M.							
	P.M.							

Remarks:

**Field Calibration of Masking  
Generator, Bone Signal, and Pads**

Date \_\_\_\_\_

Audiometer No. \_\_\_\_\_

Location \_\_\_\_\_

**1. Masking Generator Calibration**

Masking Generator Center Frequency	Masking Level Knob	Setting for		Expected Reading "C" Slow	Tolerance dB	Actual Reading Left Phone
		Black Knob	Red Knob			
500	60	80	80	81.7	± 3	_____
1000	70	80	80	88.7	± 3	_____
2000	70	90	90	94.9	± 3	_____
4000	70	80	80	82.0	± 3	_____

Note: Each field calibrator (C, D, and E) has the same expected readings for these masking generator signals.

**2. Bone Vibrator Calibration (with pad "out")**

Audiometer 40 dB at Frequency	Ballantine Voltmeter Scale Knob	Expected Reading Ballantine Red "dB" Scale	Tolerance dB	Actual Reading
500	1V	6.0	± 3	_____
1000	100MV	15.5	± 3	_____
2000	1V	1.0	± 3	_____
4000	100MV	19.0	± 4	_____

**3. Air and Bone 10dB Pad Calibration**

Audiometer Frequency	Ballantine Voltmeter Scale Knob	Ballantine Plug Position		Tolerance dB	Actual Reading		
		Pad "Out" Adjust Audio. HL Dial to give red scale reading	Pad "In" Expected Red Scale reading (dB)		Bone Pad	Rt. Phone Pad	Lt. Phone Pad
500	100MV	10dB	0	± 0.5			

\_\_\_\_\_  
Technician

ENVIRONMENTAL NOISE SURVEY (HANES)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Location

Band Center Frequency (Hz)	ANSI Max. Allowable Sound Pressure Level (Bd.) for no masking at audio zero	Band level dB/0.0002u bar	
		Air conditioning OFF	Air conditioning ON
31.5	(35)	_____	_____
63	(35)	_____	_____
125	35	_____	_____
250	35	_____	_____
500	35	_____	_____
1000	35	_____	_____
2000	42	_____	_____
4000	52	_____	_____
8000	62	_____	_____

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_  
Technician

Field Calibration of Earphones  
 For audiometer No. \_\_\_\_\_ Caravan \_\_\_\_\_

Date \_\_\_\_\_

Location \_\_\_\_\_

"C" Calibrator

Audiometer 60 dB at Frequency	Setting for		Expected Reading "A" Slow	ANSI intensity tolerance	Actual Reading	
	Black knob	Red circle			Right	Left
500	70	60	67.75	± 3 dB		
1000	70	60	66.25	± 3 dB		
2000	70	60	69.75	± 3 dB		
4000	70	70	74.75	± 4 dB		

"D" Calibrator

Audiometer 60 dB at Frequency	Setting for		Expected Reading "A" Slow	ANSI intensity tolerance	Actual Reading	
	Black knob	Red circle			Right	Left
500	70	60	67.25	± 3 dB		
1000	70	60	66.00	± 3 dB		
2000	70	60	69.50	± 3 dB		
4000	70	70	75.00	± 4 dB		

"E" Calibrator

Audiometer 60 dB at Frequency	Setting for		Expected Reading "A" Slow	ANSI intensity tolerance	Actual Reading	
	Black knob	Red circle			Right	Left
500	70	60	67.50	± 3 dB		
1000	70	60	66.00	± 3 dB		
2000	70	60	69.25	± 3 dB		
4000	70	70	74.50	± 4 dB		

\_\_\_\_\_  
 Technician

**CHAPTER 19**  
**BODY MEASUREMENTS**

Equipment

Anthropometer parts: 2 sets of four sections each, 4 sliding arms, 1 circular metal base  
Body measurement table  
Footstool  
Sliding calipers  
Skin-fold calipers  
Steel tape  
Special height scale  
Polaroid land camera  
Special light attachment for camera  
Self-balancing weight scale  
Set of weights for calibration of weight scale (one 25-lb. weight and five 50-lb. weights.  
Children's measuring board

General

Two anthropometers are provided, one as a spare. Each anthropometer consists of a rod in four sections with two caliper arms. One of the arms is fixed to the top end of the instrument; the other slides. The lower two sections are used for sitting heights and will be mounted in the circular metal base. The top section is used for bitrochanteric breadth. The remaining section can be used when required for measuring sitting heights of large examinees. The sliding calipers used to measure elbow breadth may become too loose; if so, use candle wax to tighten them.

With these anthropometers there are three sources of error which must be checked daily. The technician in charge of the body measurements should see that:

1. the anthropometer numbers read in the proper sequence and the movable arms slide freely without slipping;
2. when mounted in the base, the instrument stands vertically without support; and
3. the bottom end of the anthropometer is perfectly flush with the under-surface of the metal stand. (Do not handle anthropometers by the upper ends alone as this tends to wrench them from their bases.)



## Measuring and Recording

The examiner takes each measurement, reads it to the nearest tenth of a centimeter, and says it to the recorder. The recorder repeats the number, records it in the proper space, and says the name of the next measurement. The examiner should keep the measuring instrument set until the recorder repeats the number. If the anthropometer becomes unset in any way before the measurement is read back, the measurement should be made again. On standing measurements the recorder will insure that the subject stands erect.

A recorder is important because he helps insure the accurate recording of the measurement while also helping the examiner position the examinee correctly. The recorder also assists the examiner by seeing that the steel tape is horizontal with proper tension when girths are measured. The recorder, having had the same training as the examiner, should recognize an error in measurement or in reading from the wrong scale. (The anthropometer has two scales--ascending and descending.) When he does see an error he should call it to the examiner's attention and have the mistake corrected.

All measurements are to be taken to the nearest tenth of a centimeter except skin folds which are taken to the nearest half of a millimeter. If a skin fold is too tight to be measured write "too tight" in the recording space for that measurement.

The original examiner and recorder will complete an examination once it is started.

The measurements taken consist of various heights, breadths, and girths. All are to be taken on the right side of the body. When any of the measurements cannot be taken on the right side because of casts, amputations, or any other reasons these particular measurements should be made on the left side and the reasons noted on the recording page.

When the examinee's sample number ends in "3" or "6," four of the measurements are to be taken on the left side as well as the right side unless there is some reason it is impossible to take them on the left side. In this instance, again, the reason not taken should be noted on the body measurement page.

### Procedure

Record on the control record the examiner number and the time the procedure begins. Record on the body measurements form the examiner and recorder numbers.

Have the examinee stand with his feet together in the standard erect position for the following six measurements.

1. *Bitrochanteric breadth*.--With the top section of the anthropometer measure to the nearest 0.1 cm. the maximum breadth of the body at the level of the femoral trochanters. Compress the soft tissue as much as possible.

2. *Elbow breadth.*—Have the examinee extend his right arm forward until it is perpendicular to his body. Bend the arm so the angle at the elbow forms  $90^{\circ}$  with the fingers pointing up and the dorsal part of the wrist toward the examiner. With the sliding caliper along the axis of the upper arm, measure to the nearest 0.1 cm. the greatest breadth across the elbow joint.
3. *Upper arm girth.*—With the examinee's right arm flexed  $90^{\circ}$  at the elbow use the steel tape to measure to the nearest 0.1 cm. the distance from the acromion to the end of the humerus. Mark the lateral part of the arm at its midpoint. Have the examinee let his arm hang freely. With the steel tape, measure the circumference of the upper arm at this level. Do not compress the tissue. The recorder should insure that the tape is horizontal and at the mark on the arm.
- 4N. *Head and Chest Circumferences (Nutrition Examination Only)*
  - A. *Head Circumference (1-7 years).*—Steady the child's head and measure its greatest circumference to the nearest 0.1 cm. by placing the steel tape firmly round the frontal bones just superior to the supra-orbital ridges, passing it around the head just above the ears on each side, and laying it over the maximum occipital prominence at the back.
  - B. *Chest Circumference (1-7 years).*—Remove the child's shirt. Using the steel tape, measure to the nearest 0.1 cm. the chest circumference at the nipple line with the child breathing normally, his arms at his sides. The tape should pass around the child's back about two inches above the base of the scapula.
- 4D. *Chest Circumferences (Detailed Examination Only).*—These chest girths which are done using the narrow, flexible nonstretch tape, are measurements of the bony rib cage, not tissue measurements. The measurements are made at the level of the fourth intercostal space. To find this level palpate the sternal-manubrium junction which is at the level of the second intercostal space. Count down two intercostal spaces from this point to the fourth intercostal space. Pass the tape around the examinee's chest at this level. Smooth down the examination gown so that there are no folds or knotted-up areas. Then take the measurements to the nearest 0.1 cm. as follows:
  - A. *Full Expiration.*—Ask the examinee to take in a deep breath and then let all his air out (coach him to really get it *all* out). Take the measurement with enough tension on the tape to depress the gown and and the tissue slightly.
  - B. *Full Inspiration.*—Ask the examinee to take in a great big deep breath. Take the measurement with the same amount of tension on the tape as in the expiration measurement.

*Note:* Average chest expansion for men is about 10 cm.; for women, 7.5 cm.

5. *Triceps skin fold.*—Have the examinee let his arm hang freely at his side. With the skin-fold caliper measure to the nearest mm. the thickness of a fold of skin plus subcutaneous tissue, but no muscle, taken over the right mid-triceps at the level previously marked. The crest of the fold should be parallel to the long axis of the arm. The calipers should be applied about one cm. below the thumb and forefinger. The fingers should not be released when taking this and other skin fold measurements. Take a second measurement; if the two disagree, continue taking measurements until you get two that agree to within one mm.
6. *Subscapular skin fold.*—Measure to the nearest mm. the thickness of a fold of skin taken just below the angle of the right scapula (shoulder and arm relaxed). The fold should parallel natural cleavage lines of the skin. This is often a line about 45° from the horizontal extending medially upward. Again measure until you get two measurements that agree to within 1 mm.
7. *Sitting height (2 years old and older).*—Have the examinee sit erectly on the measuring table with his eyes straight ahead and the infraorbital-meatal line parallel to the table top. Ask him to sit as far back as possible with his feet on the appropriate step of the stool so that his thighs are horizontal, with the popliteal fossa at the table edge. Bring the movable caliper arm down firmly against the midline of the examinee's head. Take the measurement to the nearest 0.1 cm. with your eyes directly opposite the part of the caliper arm making contact with the examinee.
8. When measurements are taken on both sides of the body, ask the examinee whether he is right-handed or left-handed and record his answer by checking the appropriate box. If both sides aren't measured, check the "not applicable" box.
9. *Weight*
  - A. *Examinees who weigh 250 pounds or less:*
    - (1) Ask the examinee to stand still on the scale (in slippers).
    - (2) Insert the bottom of the body measurement page of the case record in the slot at the front of the scale's printer.
    - (3) Depress the bar on the front of the printer to record the weight on the record to the nearest quarter of a pound.
    - (4) Check to be sure that the recorded weight is legible.
    - (5) Record weight on the body measurement form in the space provided (Item 9) near the bottom of the form. Always record the weight in five digits and to the nearest 0.25 pound. If there are less than five digits, fill in the blank spaces with zeroes as appropriate; e.g., 98.5 should be entered as 098.50.
  - B. *Examinees who weigh more than 250 pounds:*

Since the scale printer will only print to 250 pounds, the following procedure must be followed if an examinee weighs more than 250 pounds:

- (1) If the examinee weighs more than 250 pounds, but less than 350 pounds:
  - (a) Move the bottom weight on the notched bar on the front of the scale to 100 pounds (far right);
  - (b) weigh the examinee and stamp his case record just as though he weighed less than 250 pounds;
  - (c) add 100 pounds to the stamped weight total on the body measurement page; and then
  - (d) record the total weight (stamped weight plus 100 pounds) in the proper space on the body measurement page.
- (2) If the examinee weighs more than 350 pounds:
  - (a) move the bottom weight on the notched bar to 100 pounds;
  - (b) move the top weight on the numbered bar to 50 pounds (far right);
  - (c) weigh the examinee and stamp his case record just as though he weighed less than 250 pounds;
  - (d) add 150 pounds to the stamped weight total on the body measurement page; and then
  - (e) record the total weight (stamped weight plus 150 pounds) in the proper space on the body measurement page.

10. Height

A. Ages 3-74:

- Records to B of Malina examinee may instructed to do gentle upward stretching.*
- (1) Have the examinee stand with his back and heels against the upright bar of the weight scale, erect ("Stand up tall" or "Stand up straight") and with feet together and head in the Frankfort plane ("Look straight ahead").
  - (2) Bring the horizontal bar down snugly to the examinee's head.
  - (3) Stick one of the case number labels next to the tape on the upright bar so the number label can be read when the height scale is photographed.
  - (4) Photograph the height measurement and ask the examinee to step down.
  - (5) Process the film and place the case number label from the height scale on the photo. Do not cover up the scale or the photographed case number.
  - (6) Record the standing height on the body measurement form as read from the photograph in the space provided (Item 10). This should be recorded in four digits to the nearest mm. (0.1 of a cm.) from the metric scale. If there are less than four digits, fill in the blank spaces with zeroes as appropriate; e.g., 99.0 should be 099.0. When the measurement is exactly at the half-way point between 2 mm., round up if the preceding whole number is odd and round down if the preceding whole number is even.

B. Ages 1-2:

The heights of children 1-2 years old are taken on the children's measuring board. For this measurement it is important to have the help of the recorder.

- (1) Keep the baby flat on the board on his back with his legs perfectly straight and feet against the left block.
- (2) Move the right block in to touch the top of the baby's head.
- (3) Take the reading from the tape measure on the board and record it
  - (a) to the nearest 0.1 cm. on the body measurement form, and
  - (b) to the nearest eighth of an inch on the body measurement form and on the physician's Report of Findings page.

## Field Checks

1. *Calipers.*—Calipers must be checked before each stand and once a week during the stand against a metric tape. The skin-fold caliper should be checked daily before use. To do this place the standards between caliper arms and see that the reading on the scale is correct according to the length of the standard. If the calipers are not right, adjust them by pressing firmly on the arms.
2. *Height.*—At the beginning and end of each stand, checks should be made to assure that:
  - A. The upright bar and tape measure have not been changed or damaged. Check the accuracy of the tape with the sitting height anthropometer. Set the sitting height anthropometer at about the middle of the height scale base. Turn the movable anthropometer's caliper arm upside down. Take a picture of the height measurement. Read the anthropometer measurement the same way as for sitting height and record the reading on the back of the photograph. Send the photograph to the Chief, Quality Control Section, Headquarters. The photograph should include the stand number and location, date, number of persons who checked the scale, anthropometer reading, and whether it was the beginning or end of the stand.
  - B. The horizontal bar is firmly attached to the upright section that slides on the upright bar.
  - C. The camera and light are working to produce optimum photos. Repairs and adjustments should be made as soon as possible. This equipment is the only means we have for measuring height.
3. *Weight.*—At the beginning of each stand before the examinations begin and again at the end of the stand, the scale should be calibrated at zero and at intervals of 25 pounds all the way up to 250 pounds. If the scale is out of calibration by a constant amount at all calibration weights, correct the error with the adjustment knob on the left side of the scale. If the trailer is not level the scale will have to be zeroed. If adjusted to lower than 0.00 it will read E.EE; but when adjusted correctly it will read 0.00. After zeroing the scale properly, stamp zero on any ordinary sheet of 8x10½ paper. Then weigh the calibration weights in increments of 25 pounds, starting with 25 pounds and going up to 250 pounds, stamping

each weight on the paper. Altogether, eleven recordings should be made on the paper. The paper with the recorded weights should also include the stand number and location, date, the number of the person doing the check procedure, and whether it was the beginning or end of the stand.

The recording should be mailed immediately to the Chief, Quality Control Section, Headquarters.

The ribbon for printing the weight will need occasional replacement (approximately every 6 months). When the printing starts getting dim call a Toledo Scales dealer for replacement ribbon.

At the end of each stand, turn the scale lock to a vertical position for transit.

## CHAPTER 20

### GONIOMETRY

#### Equipment

Double-armed universal goniometer

#### General

Goniometry means the measurement of angles. More specifically, in our survey, it means the measurement in degrees of the range of motion of certain joints, the hip and the knee. The natural anatomical position of the joint is, in general, considered to be zero degrees. The measurement is taken while the pivot of the goniometer is over the axis of motion of the joint. Since the axis of motion may shift somewhat when the joint is moved, care should be taken to be sure the pivot is as closely as possible over the axis when the measurement is taken.

#### Measuring and Recording

The examiner takes each measurement, reads it to the nearest five degrees, and says it to the recorder. The recorder repeats the number, records it in the proper space, and says the name of the next measurement. The examiner should keep the goniometer set until the recorder repeats the number. If the goniometer becomes unset in any way before the measurement is read back, the measurement should be made again.

A recorder is important because he helps insure the accurate recording of the measurement while also helping the examiner position the examinee correctly. The recorder should recognize an error in measurement or in reading from the goniometer scale. When he does, he should call it to the examiner's attention and have the mistake corrected.

All measurements should be taken on both sides of the body. If any measurement cannot be taken because of a cast, amputation, or any other reason, note on the recording page the measurement and reason not taken.

The original examiner and recorder should complete an examination once it has started.

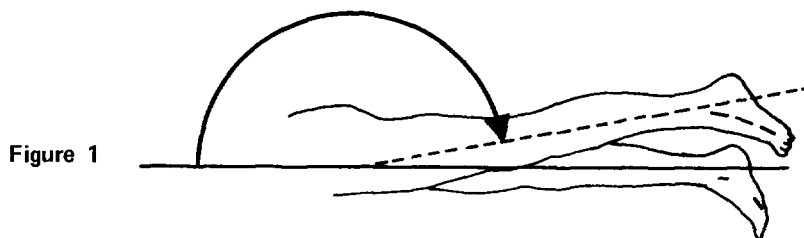
## Procedure

### Preliminary

1. Record on the control record the time the procedure begins.
2. Record on the "Goniometry" form the examiner number and the recorder number.
3. Before taking each measurement have the examinee practice the motion to loosen up his joints and muscles.

### Extension of hip (figure 1)

1. Have the examinee lie on his stomach with both hips firmly resting on the table.
2. Ask him to lift his entire near leg as high as he can without bending his knee or lifting either hip off the table.
3. Have him relax and then repeat the procedure.
4. Place the stationary arm of the goniometer alongside and parallel to the long axis of the trunk and the movable arm along the lateral midline of the near femur with the pivot point over the greater trochanter.
5. Take the measurement, which should normally be an angle between  $180^{\circ}$  and  $160^{\circ}$ .



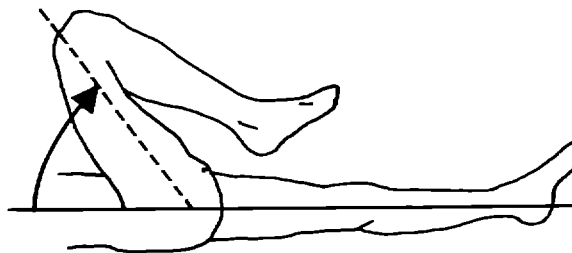
### Flexion of hip (figure 2)

1. Have the examinee lie on his back with the knee on the side being measured flexed and the opposite knee and hip straight and flat on the table.
2. Have him bring his knee as far up toward his chest as possible.
3. Have him relax the leg and then repeat the procedure.
4. Place the stationary arm of the goniometer alongside and parallel to the long axis of the trunk and the movable arm along the lateral midline of the femur with the pivot point over the greater trochanter.



5. Take the measurement, which should normally be an angle between  $180^{\circ}$  and  $55^{\circ}$ .

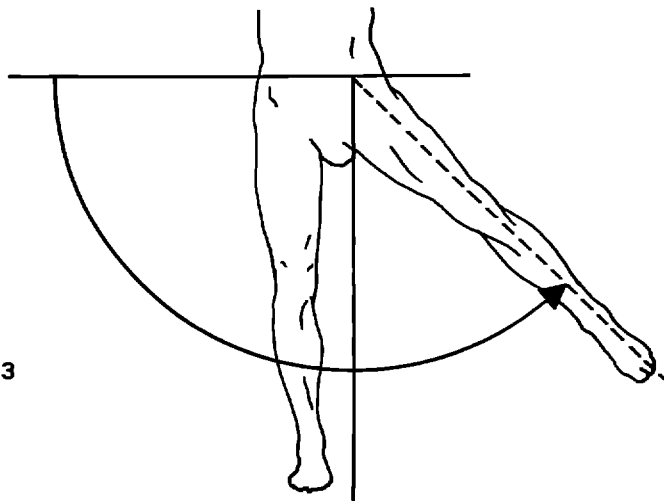
Figure 2



#### Abduction and adduction of hip (figure 3)

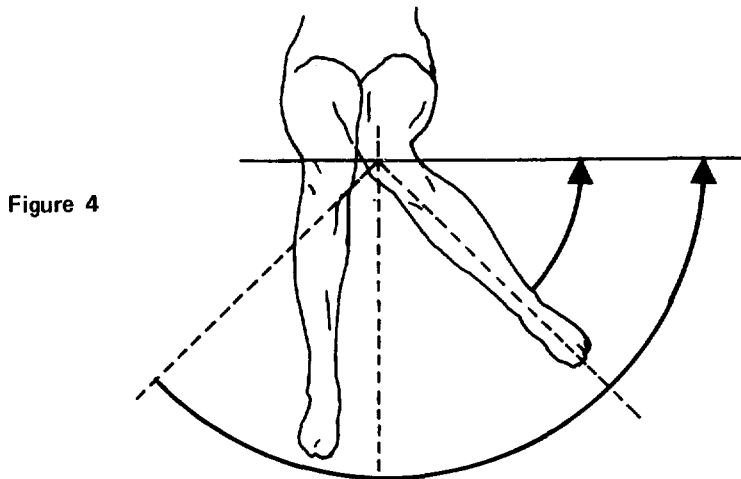
1. Have the examinee lie on his back with both legs straight and together. The adduction of the hip is normally an observed measure of zero degrees. (If it isn't, then measure and record the correct angle of adduction. Subtract the angle from  $180^{\circ}$  and record it as a two-digit number.)
2. Tell the examinee that you are going to carry the weight of his leg while he relaxes and moves his leg as far sideways as possible.
3. While you are holding his leg with the knee straight, have the examinee move his leg out to the side.
4. Have him relax and repeat the procedure while putting one finger on each of his anterior superior iliac spines.
5. Place the stationary arm of the goniometer across the pelvic area along the line between the anterior superior iliac spines with the pivot point over the anterior superior iliac spine of the leg being measured.
6. Place the movable arm along the anterior midline of the femur and measure the abduction of the hip.
7. Read and record the obtuse angle between the arms of the goniometer. This angle should be between  $90^{\circ}$  and  $140^{\circ}$ .

Figure 3



#### Internal and external rotation of hip (figure 4)

1. Have the examinee sit with his legs over the side of the table and knees flexed to 90 degrees.
2. Making sure he does not raise his hips from the table, have him swing one leg and then the other to the inside as far as he can and then to the outside as far as he can.
3. Have him relax and repeat the procedure while you measure.
4. Place the stationary arm in your right hand and hold it parallel to the table top.
5. With the anterior aspect of the knee as a pivot point and with the movable arm of the goniometer along the anterior tibial crest, follow the leg in and take the measurement of internal rotation.
6. Follow the leg out and take the measurement of external rotation.
7. For the measurements of external rotation of the right hip and internal rotation of the left hip, the angle should be between  $90^{\circ}$  and about  $140^{\circ}$ .
8. For the measurements of external rotation of the left hip and internal rotation of the right hip, the angle should be between about  $40^{\circ}$  and  $90^{\circ}$ .



#### Extension and flexion of knee (figure 5)

1. Have the examinee lie on his back with legs extended. The extension of the knee is normally an observed measure of zero degrees with the back of the knee flat on the table. (If not, then measure and record the correct angle of the knee while the leg is extended as fully as possible. Subtract the angle from  $180^{\circ}$  and record it as a two-digit number.)
2. Have the examinee flex his knee, tightening it as much as possible while still keeping his foot flat on the table.
3. Have him relax and repeat the procedure while you measure.

4. Place the stationary arm parallel to the femur on a line from the lateral condyle to the greater trochanter with the pivot point over the distal lateral condyle of the femur.
5. Place the movable arm parallel to the fibula in line with the lateral malleolus.
6. Take the measurement, which should be an angle between  $180^{\circ}$  and  $30^{\circ}$ .

Figure 5

