

THE DALLAS HEART STUDY

The Donald W. Reynolds Cardiovascular Clinical Research Center at University of Texas Southwestern Medical Center

Brief history: The Dallas Heart Study was designed in 1999 by Drs. Ronald Victor and Helen Hobbs as part of a grant application to the Donald W. Reynolds Foundation. The original mandate was to establish, at one medical center, a comprehensive cardiovascular research program that extended from very basic, molecular studies performed in the laboratory to population-based and community intervention studies. The ultimate goal was to support work that would make a palpable impact on the diagnosis, prevention and treatment of heart disease.

The Dallas Heart Study is the centerpiece of the Donald W. Reynolds Cardiovascular Clinical Research Center in Dallas, one of three such Centers (the other Centers are at Harvard and Johns Hopkins). DHS-1 refers to the first collection of the population sample from Dallas County, which occurred between 2000 and 2002. The study was transformed from a cross-sectional study to a longitudinal study in 2007 (DHS-2) when the blood sample collection, imaging studies, and other phenotypes will be repeated in the DHS-1 participants.

GENERAL DESCRIPTION OF DALLAS HEART STUDY

The Dallas Heart Study (DHS) is a multi-ethnic, population-based probability sample of Dallas County designed to define the social and the biological variables contributing to ethnic differences in cardiovascular health at the community level and to support hypothesis-driven research aimed at determining the underlying mechanisms contributing to differences in cardiovascular risk. The initial data collection from the population was performed in three sequential stages over a two year period (2000-2002) and included the collection of detailed socioeconomic, biomarker and imaging data from each participant. The underlying assumption of the study is that successful identification of new risk factors for cardiovascular disease will require the availability of an exquisitely phenotyped, multiethnic population in close proximity to the Center.

Overview of Study Design: DHS-1

The sampling frame for the study was developed by Research Triangle Institute. A probability-based algorithm was used to select equal numbers of African-Americans and non-African-American adults (ages 18 - 65 years) from 811,015 postal addresses in Dallas County for entry into the study. A stratified (by census tract) random sample of addresses produced 15,088 possible addresses. Of the 7,586 eligible for the study, 6,101 (or 80%) participated in *Visit 1* (an in-home structured interview). All individuals between ages 30-65 who completed *Visit 1* were invited to participate in *Visit 2* (a second in-home visit at which blood and urine samples were obtained). Of the 3,557 study participants who completed *Visit 2*, 3,072 completed *Visit 3*. During *Visit 3*, each participant obtained several imaging studies, including dual-energy x-ray absorptiometry (DXA), magnetic resonance imaging (MRI), electron beam computed tomography (EBCT)).

Visit 1: Survey in Home (n=6,101: 18-65 years)

After informed consent was obtained (which included an ethnic-specific video in which well known members of the community discussed specific concerns regarding participation in research), a 60 minute, computer-assisted structured interview of 6,101 subjects was obtained in the home. The information was captured on a lap-top computer and included answers to questions regarding demographics, socioeconomic status, health beliefs, family history, medical history and medications. Blood pressure, heart rate, and weight were obtained at this visit. Ethnicity was self-assigned.

Table 1: Distribution of 6,101 participant completing *Visit 1* stratified by gender and ethnicity.

Ethnic Group	Men	Women	Total	Percentage
African-American	1,572	1,837	3,409	56%
Caucasian	675	735	1,410	23%
Hispanics	539	623	1,162	19%
Other	64	56	120	2%

Data collected:

1. Informed consent

2. DHS Health Survey included the following modules:

- MODULE 1: PERSONAL HISTORY/SOCIODEMOGRAPHICS
- MODULE 2: FAMILY HISTORY
- MODULE 3: MEDICAL HISTORY: ATHEROSCLEROTIC HEART DISEASE
- MODULE 4: HEART DISEASE BELIEFS
- MODULE 5: MEDICAL HISTORY: DYSLIPIDEMIA
- MODULE 6: HIGH CHOLESTEROL BELIEFS
- MODULE 7: MEDICAL HISTORY: DIABETES
- MODULE 8: DIABETES BELIEFS
- MODULE 9: MEDICAL HISTORY: HIGH BLOOD PRESSURE/HYPERTENSION
- MODULE 10: HIGH BLOOD PRESSURE/HYPERTENSION BELIEFS
- MODULE 11: WOMEN'S HEALTH
- MODULE 12: SYMPTOMS
- MODULE 13: COMORBID CONDITIONS/GENERAL HEALTH
- MODULE 14: HEALTH CARE ACCESS AND UTILIZATION
- MODULE 15: PHYSICAL ACTIVITY
- MODULE 16: WEIGHT HISTORY
- MODULE 17: DRINKING PATTERNS
- MODULE 18: TOBACCO USE
- MODULE 19: SOCIAL SUPPORT
- MODULE 20: ACCULTURATION
- MODULE 21: NEIGHBORHOOD QUESTIONNAIRE
- MODULE 22: DISCRIMINATION
- MODULE 23: INCOME/SOCIOECONOMICS
- MODULE 24: BLOOD PRESSURE AND PULSE MEASUREMENT
- MODULE 25: HEIGHT & WEIGHT MEASUREMENT

A copy of the survey is available upon request (Teresa.Eversole@utsouthwestern.edu).

3. **Blood pressure:** Five blood pressure (and heart rate) measurements were obtained in the seated position using an automatic oscillometric device (Series 52,000 Welch Allyn, Inc.); the device was validated against direct catheter-based measurements of intra-arterial pressure. Field interviewers were trained to use the device and to select an appropriately sized cuff.

4. **Weight:** Field weight measurements were conducted using a Health-O-Meter digital lithium electronic field scale.

Visit 2: Phlebotomy in Home (n=3,410: 30-65 y; n=147: 18-29 y)

All study participants between ages 30 and 65 who completed *Visit 1* were invited to complete *Visit 2*. Early in the study, study participants <age 30 years who completed *Visit 1* were invited to complete *Visit 2*, accounting for the 147 subjects under age 30 included in this visit. Study personnel visited the home of the participant and collected a fasting venous blood sample and a first-morning urine sample. The blood and urine were maintained on ice during transport to the medical center. Plasma and serum were isolated and aliquoted for storage (1). The white blood cells were isolated and genomic DNA was extracted from the cells (1). Lymphocytes were isolated and stored for future immortalization, if the genomic DNA became depleted (1).

Table 2: Distribution of 3,557 participant completing *Visit 2* stratified by gender and ethnicity.

Ethnic Group	Men	Women	Total	Percentage
Blacks	773	1,057	1,830	52%
Whites	501	547	1,048	29%
Hispanics	252	351	603	17%
Other	44	32	76	2%

Table 3. Laboratory analytes measured in the Dallas Heart Study.

Analyte	Assay	Investigator
Chem 20	--	--
Lipoproteins	Grundy	N/A
Lipoprotein sizing by NMR	Otvos	Grundy, Vega, Hobbs
Lipoprotein sizing by gel electroph	Krauss	Grundy, Vega
Lp(a) levels and isoforms	Marcovina (U. of Washington)	Hobbs
Homocysteine	Otvos	Hobbs
FSH	DSL	Chang
LH	DSL	Chang
Testosterone, free	DSL	Chang
Testosterone, total	DSL	Chang
Sex Hormone Binding Globulin	DSL	Chang
BNP	Biosite	de Lemos
MCP-1	Biosite	de Lemos
Adiponectin	Biosite	de Lemos
CCL11	Biosite	de Lemos

sRAGE	Biosite	de Lemos
BNP-3-108	Biosite	de Lemos
LTBR	Biosite	de Lemos
CXCL2	Biosite	de Lemos
CXCL1	Biosite	de Lemos
MIP3	Biosite	de Lemos
Caspase 3	Biosite	de Lemos
NGAL	Biosite	de Lemos
PGRP-S	Biosite	de Lemos
ESAM	Biosite	de Lemos
Cystatin C	Biosite	de Lemos
IL-18	Biosite	de Lemos
cTnT	Biosite	de Lemos
hs-CRP	Roche	de Lemos, Grundy
Troponin T	Roche	de Lemos
Beta-crosslaps	Roche	Vega
Fructosamine	Roche	McGuire
NT proBNP	Roche	Dries/de Lemos
Leptin	Luminex	Hobbs/Grundy
Insulin	Luminex	Hobbs/Grundy
sCD40L	Bender Sys	Harvard/de Lemos
Apelin	Biorad	Stanford/de Lemos
Osteoprotegerin	R&D Sys	Omland/de Lemos
ANA	Wakeland	Wakeland
CCP	Wakeland	Wakeland
Oxidized PL (E06)	Witztum	Hobbs
Malondialdehyde-LDL	Witztum	Hobbs
Urine	Creatinine	Victor, Toto
Urine	Potassium	Victor, Toto
Urine	Sodium	Victor, Toto
Urine	Microalbumin	Victor, Toto

Visit 3: The Clinic Visit (n=2,989: 30-65 y; n=83: 18-29 y)

Each participant who completed *Visit 1* and *Visit 2* was invited to participate in the clinic visit at UT Southwestern. A total of 3,072 participants completed the clinic visit.

Table 4: Distribution of 3,072 participant completing *Visit 3* stratified by gender and ethnicity.

Ethnic Group	Men	Women	Total	Percentages
Blacks	653	886	1,539	50%
Whites	469	489	958	31%
Hispanics	217	295	512	17%
Other	38	25	63	2%

The following studies were performed during the 2 hour visit:

1. **Twelve-lead electrocardiography (ECG)** was measured using a General Electric (GE) Marquette Medical System with a MAC 5000 hardware and software configuration:
 - Rate
 - Rhythm
 - Intervals (PR, QRS, QT)
 - Voltage
2. **Cardiac magnetic resonance imaging (MRI)** using a 1.5 Tesla Phillips device
 - LV mass
 - LV ejection fraction
 - LV wall thickness
 - LA size
3. **Thoracic aorta MRI**
 - Aortic compliance
 - Thoracic aortic wall thickness
 - Pulse Wave velocity
4. **Abdominal aorta MRI**
 - Presence of aortic plaque
 - Amount of aortic plaque
 - Abdominal aortic wall thickness
5. **Abdomen MRI**
 - Subcutaneous fat
 - Retroperitoneal fat
 - Intra-peritoneal fat
6. **Pelvic MRI** (women aged 35-49)
 - Ovarian size
 - Ovarian structure
7. **Proton magnetic resonance spectroscopy (MRS) of the liver**
 - Hepatic triglyceride content
8. **Cardiac electron beam computed tomographic (EBCT):** Imatron EBCT scanner
 - Coronary calcium score
 - Coronary calcium volume
9. **Dual-energy x-ray absorptiometry (DXA) scan**
 - Percent body fat
 - Total body fat
 - Quantification of fat in arms, legs, upper body, lower body, abdomen
 - Lean body mass
 - Bone mineral density
10. **Height:** Medical office scale without shoes.
11. **Weight:** Clothed using gravimetric weight scale.
12. **Waist & hip circumference** (measured in centimeters)
13. **Medications**
 - Prescription medications

- Over the counter medications, vitamins & supplements

Overview of Study Design: DHS-2

The DHS was transformed from a cross-sectional to longitudinal study in 2007. All prior DHS participants (n=3,321) are being invited to return to the clinic for repeat evaluation to determine who had developed cardiovascular disease in the seven year interval since the initial survey. Phenotypes that are being collected on up to 3000 participants include the following:

- 1. Twelve-lead electrocardiography (ECG)** was measured using a General Electric (GE) Marquette Medical System with a MAC 5000 hardware and software configuration:
 - Rate
 - Rhythm
 - Intervals (PR, QRS, QT)
 - Voltage
- 2. Cardiac magnetic resonance imaging (MRI)** using a 3.0 Tesla Phillips device
 - LV mass
 - LV ejection fraction
 - LV wall thickness
 - LV systolic and diastolic strain and strain rate
 - LV diastolic untwisting
 - LA volume and function
- 3. Thoracic aorta MRI**
 - Aortic compliance
 - Aortic flow
- 4. Abdominal aorta MRI**
 - Presence of aortic plaque
 - Amount of aortic plaque
 - Aortic Wall Thickness
 - Progression since DHS-1
- 5. Carotid MRI**
 - Mean wall thickness
 - Maximum wall thickness
 - Amount of carotid plaque
 - Plaque characterization
- 6. Brain MRI**
 - Gray matter volume (normalized)
 - White matter volume (normalized)
 - CSF volume (normalized)
 - White matter hyperintensities
- 7. Proton magnetic resonance spectroscopy (MRS) of the liver**
 - Hepatic triglyceride content
- 8. Cardiac Multi-detector Computerized Tomography (MDCT):** Toshiba Aquilon 64-Slice MDCT
 - Coronary calcium score (attenuation corrected)

- Coronary calcium volume (attenuation corrected)
 - Coronary calcium mass (attenuation corrected)
 - Coronary calcium distribution
 - Calcium progression since DHS1(attenuation corrected)
9. **Dual-energy x-ray absorptiometry (DXA) scan:** Hologic Discovery
 - Percent body fat
 - Total body fat
 - Quantification of fat in arms, legs, upper body, lower body, abdomen
 - Lean body mass
 - Bone mineral density- hip, spine, forearm, whole body.
 10. **Blood Pressure and Pulse:** Welch Allyn 52000 monitors
 - 6 measurements taken
 11. **Ankle Brachial Blood Pressure:** Unetixs vascular system
 12. **Acoustic Cardiogram:** Audicor
 13. **Exercise Testing:** True Treadmill
 14. **Accelerometer** (Mini Mitter- Respironics) for 7 day exercise testing
 15. **Health Survey:** Checkbox, Prezza Technologies
 - Family history, medical history, depression, women's health, socioeconomic status, physical activity, depression index
 16. **Montreal Cognitive Assessment:** Validated Mental Status Test
 17. **Height:** Medical office scale without shoes.
 18. **Weight:** Clothed using gravimetric weight scale.
 19. **Waist & hip circumference** (measured in centimeters)
 20. **Medication list**
 - Prescription medications
 - Over the counter medications, vitamins & supplements

COHORT FOLLOW-UP

Annual phone calls to DHS participants are made during which health status, address, and contact information is up-dated. Newsletters and gifts are mailed periodically.

HEALTH OUTCOMES DATA

1. **National Death Index (NDI) search:** NDI searches provide database information pertaining to deceased individuals within the identified DHS cohort population and cause of death. In addition to annual NDI reports, the DHS cohort relationship management team attempts to capture near-real time death information through obituary and self-report (family or second contact) information as it becomes available.

2. **Dallas/Fort Worth Hospital Council (DFWHC) database:** This database provides information regarding the hospitalization of study participants who have provided an informed consent. The report covers reporting hospitals in the Dallas County area and is obtained quarterly by UT Southwestern. In DHS-1, informed consent was obtained

during the Visit 3 (Imaging/Clinic Visit) at UT Southwestern Medical Center. During the conduct of DHS-2 (2007-2009), updates to the informed consent to facilitate event adjudication will be requested during the 4.5 hour clinic visits at UT Southwestern.

3. Health survey: An extensive multi-module DHS Health Survey was completed as part of Visit 1 during the original DHS in CY 2000. In DHS-2, the multi-module DHS Health Survey will be administered to all participants at UT Southwestern Medical Center using a skip-logic enabled survey developed by DHS investigators and epidemiologists. In addition, an annual health survey is captured during the DHS cohort relationship management activities via telephone in order to update the 'current' health status of DHS participants.

RESOURCES:

General information regarding the Reynolds Center at UT Southwestern:

[Http://reynolds.swmed.edu/default.html](http://reynolds.swmed.edu/default.html)

This link includes a list of papers published using data from the Dallas Heart Study (see Dallas Heart Study link and DHS Bibliography)

General information regarding the Donald W. Reynolds Foundation and the supported Donald W. Reynolds Cardiovascular Clinical Research Centers can be obtained by visiting www.ReynoldsCenters.org

PROGRAM CONTACTS:

Table 5. Dallas Heart Study Investigators and Staff

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