The Cardiovascular Health Study
Opportunities for answering more questions about aging

Anne B. Newman, MD, MPH
Professor of Epidemiology and Geriatric Medicine
University of Pittsburgh

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N01-HC-85079 through N01-HC-85086, N01-HC-35129, and N01-HC-15103
The participants
- 5888 men and women from 4 US communities
- Annual examinations 1989-90 to 1998-99
- Continued telephone contact (95% of survivors)

The investigators
- Representing many fields such as cardiology, neurology, geriatrics, general medicine as well as many institutions
- Over 300 publications
- Over 100 ancillary studies
- Repository of stored specimens including DNA

CHS website: http://www.chs-nhlbi.org
CHD rates in CHS by age group and gender

Framework for the study of subclinical cardiovascular disease

Traditional CVD Risk Factors
- Age
- Gender
- Hypertension
- Diabetes
- Smoking
- high LDL-C
- Low HDL-C

Subclinical CVD
- US – carotid wall thickness, stenosis
- Echo – global and regional LV wall motion abnormalities
- Ankle-arm index
- ECG
- Brain MRI
- Coronary Artery Calcification

Clinical events
- MI
- Angina
- CHF
- PAD
- Stroke

New Risk Factors or Effect Modifiers
- CRP
- Fibrinogen, others

Geriatric Syndromes
- Cognitive decline
- Frailty
- Successful aging
- Disability

Mortality
- CVD death
- All cause
Prevalence of Clinical and Subclinical CVD by Age, and Gender

Cardiovascular Health Study, n=4,946; years:

Women

Men

Probabilities of successful aging by subclinical CVD status in CHS


(A), no difficulty in activities of daily living (ADL)
Frailty in CHS
Survival curve estimates (unadjusted) over 72 months of follow-up by frailty status at baseline

Semiannual contacts

- 5,888 participants aged 65+ enrolled in 2 cohorts: 5201 in 1989-90, and 687 in 1992-93

- 1989-1999 annual clinic visits and 6 month phone calls

- 1999-present: 6 month phone calls for hospitalizations or reported illness (CVD plus asthma, diabetes), medications, self-reported health, change in activities of daily living, marital status

- 2005-2006: Follow-up exam for function: The CHS All Stars study funded by NIA
Clinic visit data

- SPSS data files for each Year or call
- Year designation not intuitive (BL=Yr 2)
- Second cohort added 3 years after BL = Year 5 = 1992-93
- 5th follow-up?
  Year 7 = 1994-95 for original cohort
  Year 10 = 1997-98 for new cohort
Data, cont’d

- Variable names include 2 digit record number, eg ACE06, BP07, BP37, HIBP29, BP57, HIBP59
- Follow up through May 30, 2004 (Year 16) is 89% complete
Data collected annually

- Medical & personal history
- Medication use
- ECG
- Cognitive & physical function
- Depression
- Weight
Frequently Collected Data

- Timed walk
- Blood pressure
- Total cholesterol
- Over the counter meds (Yr 6 on)
- Benton Visual Retention (Yrs 6-9, 11)
Repeated measures

- Phlebotomy (HDL, LDL, insulin, glucose, CRP, creatinine)
- Echocardiography (BL, Yr 7)
- Carotid ultrasound (BL, Yr 5, Yr 11)
- Ankle Arm Index (BL, Yr 5, Yr 11)
- Cranial MRI (Yrs 5-6, 10-11)
- Physical Activity (BL, Yr 5, Yr 9)
- Pulmonary Function (BL, Yr 6, Yr 9)
- Nutrition (BL, Yr 8)
Single measures

- Bioelectric impedance (BL)
- Abdominal aortic ultrasound (Yr 5)
- Sleep & asthma (Yr 6)
- 6 minute walk, oximetry (Yr 9)
- Urinary albumin (Yr 9)
- Retinal photography (Yr 10)
- Endothelial function (Yr 10)
- Audiometry (Yr 11)
- Vibration / Tuning Fork (Yr 11)
Available in subsets

- DXA scan (Yr 7 or 8)
- Holter monitor (BL, Yr 7)
- Dementia status
- Thyroid function (BL)
- Caregiver screening
- Genetic markers / other blood lab data
  (see Section 8 of manual)
Diabetes related data

- Self-report of diabetes annually
- Insulin or OHGA use annually
- Duration: BL for new cohort, Yr 11 for all
- Fasting glucose (BL, Yr 5, Yr 9)
- 2-hr glucose (BL, Yr 9)
- Fasting insulin (BL, Yr 5)
- 2-hr insulin (BL)
- Components of metabolic syndrome (waist, triglycerides, HDL, BP, fasting glucose; BL, Yr 5)
Diabetes, cont’d.

• Diabetes by ADA at baseline:
  785 IFG
  439 New diabetes
  516 Known diabetes

• Through Yr 11, 377 new cases identified by medication use
Subclinical Disease

Composite Measure:
AAI <= 0.9
Major ECG abnormalities
Rose angina or claudication
Carotid stenosis >= 25%
Carotid wall thickness > 80th %ile
Abnormal wall motion or ejection fraction
Events

- Main endpoints--MI, angina, CHF, stroke, TIA, PAD and total mortality--reviewed by committees

- Diagnoses and procedure codes from all hospitalizations

- Acute precipitant interviews for cardiac and cerebrovascular events
Subclinical, cont’d

- MRI data: white matter grade, ventricle grade, infarcts
- Abdominal aortic ultrasound
- Carotid plaque characteristics
- Endothelial function
- Coronary calcium in a subset
## Cohort at Baseline

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>72.8 yrs (65-100)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2495</td>
<td>(42.4%)</td>
</tr>
<tr>
<td>Black race</td>
<td>924</td>
<td>(15.7%)</td>
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<tr>
<td>CVD</td>
<td>1826</td>
<td>(31.0%)</td>
</tr>
<tr>
<td>HS grad</td>
<td>4139</td>
<td>(70.3%)</td>
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<tr>
<td>Self-reported health</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>Excellent</td>
<td>790</td>
<td>(13.4%)</td>
</tr>
<tr>
<td>Very Good</td>
<td>1415</td>
<td>(24.0%)</td>
</tr>
<tr>
<td>Good</td>
<td>2175</td>
<td>(36.9%)</td>
</tr>
<tr>
<td>Fair</td>
<td>1256</td>
<td>(21.3%)</td>
</tr>
<tr>
<td>Poor</td>
<td>239</td>
<td>(4.1%)</td>
</tr>
</tbody>
</table>
## Number of events through 6/30/02

<table>
<thead>
<tr>
<th>Event</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Angina</td>
<td>1064</td>
</tr>
<tr>
<td>MI</td>
<td>696</td>
</tr>
<tr>
<td>CHF</td>
<td>1262</td>
</tr>
<tr>
<td>PAD</td>
<td>245</td>
</tr>
<tr>
<td>Stroke</td>
<td>789</td>
</tr>
<tr>
<td>TIA</td>
<td>212</td>
</tr>
<tr>
<td>Death</td>
<td>2658</td>
</tr>
</tbody>
</table>
CVD/CHF cont’d

- Other endpoints: atrial fibrillation by ECG and/or ICD-9 codes, deep vein thrombosis, sudden death
- Hospital echocardiograms read to characterize heart failure as systolic or diastolic
- Study echos recently re-read to measure left atrial size
Aging and function

- Cognitive function annually (3MS, DSST)
- ADL, IADL, walk ½ mile annually
- Comorbidities: COPD, cancer
- Performance based measures: timed walk, grip strength, chair stands, finger tapping, leg lift
- Self-reported health, days in bed
Self report

• nursing home stay
• hospitalizations
• home health care (Yrs 8-11)
• usual medical care (Yrs 6,9)
• insurance other than Medicare
• reasons for not seeing doctor
• flu / pneumonia shot annually
Health Services, cont’d

• CMS data through 1998
• Group at Duke approved to get Medicare A & B data through 2002
• Total costs/person available, but not by diagnosis
• Significant amount of effort needed to retrieve cost data for specific project
Major ancillary studies

- **CHS Meds** – Psaty, PI, collected and coded annual medication use
- **Sleep Heart Health Study** – Robbins, Newman, Punjabi, PI’s, about 1250 men and women from three CHS field centers
- **CHS Cognition Study** – Kuller, PI, determined dementia end-points in 3660 who had brain MRI
- **CHS All Stars Study** – Newman, PI, trajectories to function
- **CHS Events follow-up** – Psaty, PI, long term risk for CVD events
Mechanism to get involved

- Study the website and published papers (http://www.chs-nhlbi.org)
- Secure CHS sponsor
- Develop manuscript and/or ancillary study proposal
- Submit for review and approval
- Sign Data Distribution Agreement (DDA)
- Alternative: request data from NHLBI public use site – Shorter follow-up, limited ancillary study data (http://www.nhlbi.nih.gov/resources/deca/directory.htm)
• Collaborating Investigators working with CHS investigators in topic areas
• Supported by transition contract funds (NHLBI)
• Active working groups:
  – Renal
  – Diabetes
  – Stroke
  – CHF
  – Health care utilization
  – Aging and geriatrics
• Newman AB, Siscovick D. The Cardiovascular Health Study: risk factors, subclinical disease, and clinical cardiovascular disease in older adults.

• Mathew ST, et al. Congestive heart failure in the elderly: the Cardiovascular Health Study.


• Shlipak MG, et al. Chronic renal insufficiency and cardiovascular events in the elderly: findings from the Cardiovascular Health Study.
Weber MA, Wenger NK, Scheidt S. Insights from the Cardiovascular Health Study in older adults and from other original contributions.


Mozaffarian D, et al. Lifestyles of older adults: can we influence cardiovascular risk in older adults?

The Cardiovascular Health Study

Sponsored by the National Heart, Lung and Blood Institute

The Cardiovascular Health Study (CHS) is an NHLBI-funded observational study of risk factors for cardiovascular disease in adults 65 years or older. Starting in 1989, and continuing through 1999, participants underwent annual extensive clinical examinations. Measurements included traditional risk factors such as blood pressure and lipids as well as measures of subclinical disease, including echocardiography of the heart, carotid ultrasound, and cranial magnetic-resonance imaging (MRI). At six month intervals between clinic visits, and once clinic visits ended, participants were contacted by phone to ascertain hospitalizations and health status. The main outcomes are coronary heart disease (CHD), angina, heart failure (HF), stroke, transient ischemic attack (TIA), claudication, and mortality. Participants continue to be followed for these events. To date, more than 400 research papers from CHS have been published and more than 120 ancillary studies are ongoing or complete. Read More.

Principal Investigators and Study Sites
Final Comments

• Wealth of data collected over 18 years
• Lots of papers proposed and written, but plenty still to do
• Analytic support still active at the Coordinating Center