



National Surveys: What is Measured and Why (and How)

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Today's Outline

- **Why**
- **How**
- **What**

Focus of Demographic Health Research: Differences and Trends in Health Outcomes

Demographic Factors

Age
Gender
Ethnicity
Race/
Nativity



Health Outcomes

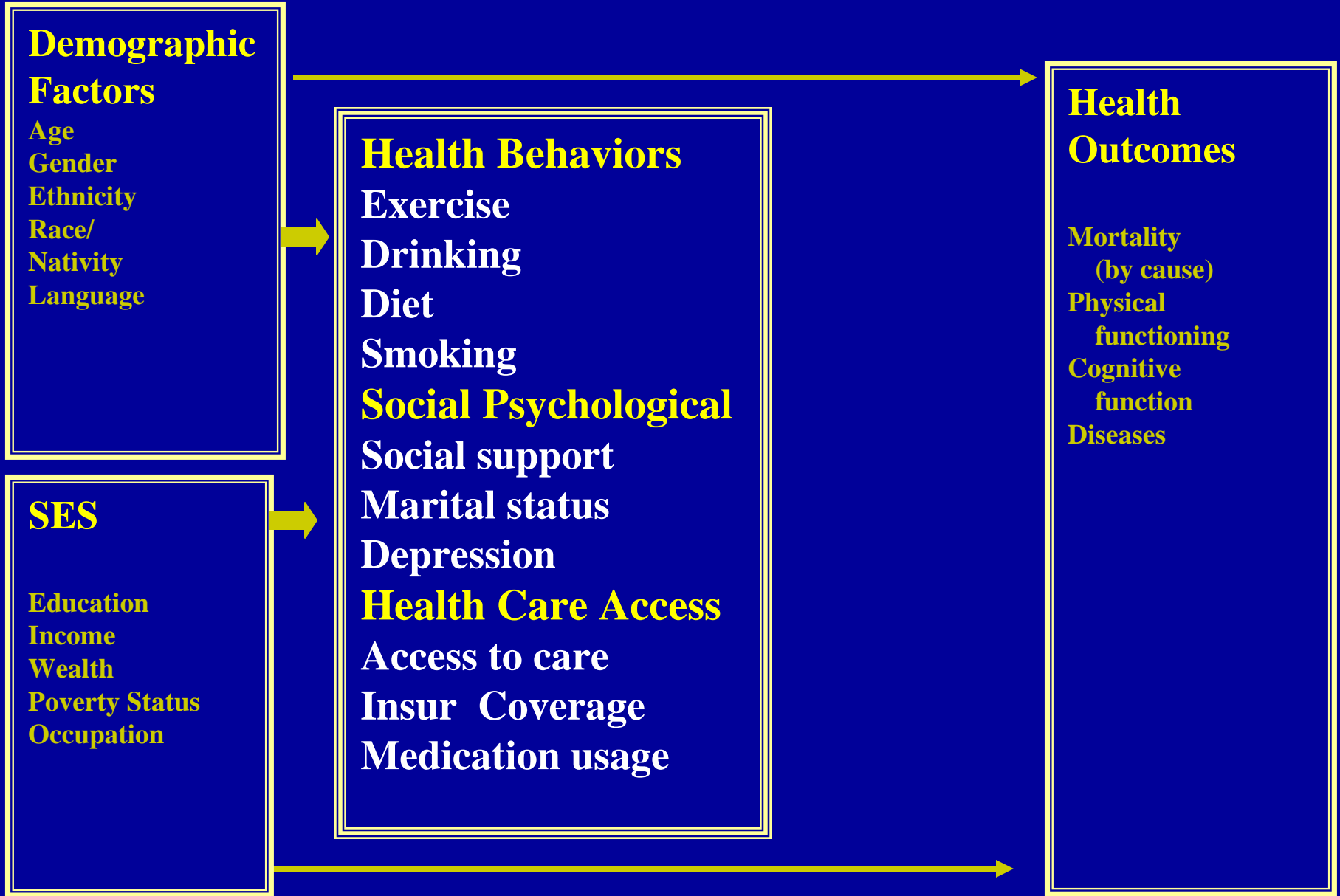
Mortality
(by cause)
Physical
functioning
Cognitive
functioning
Diseases

SES

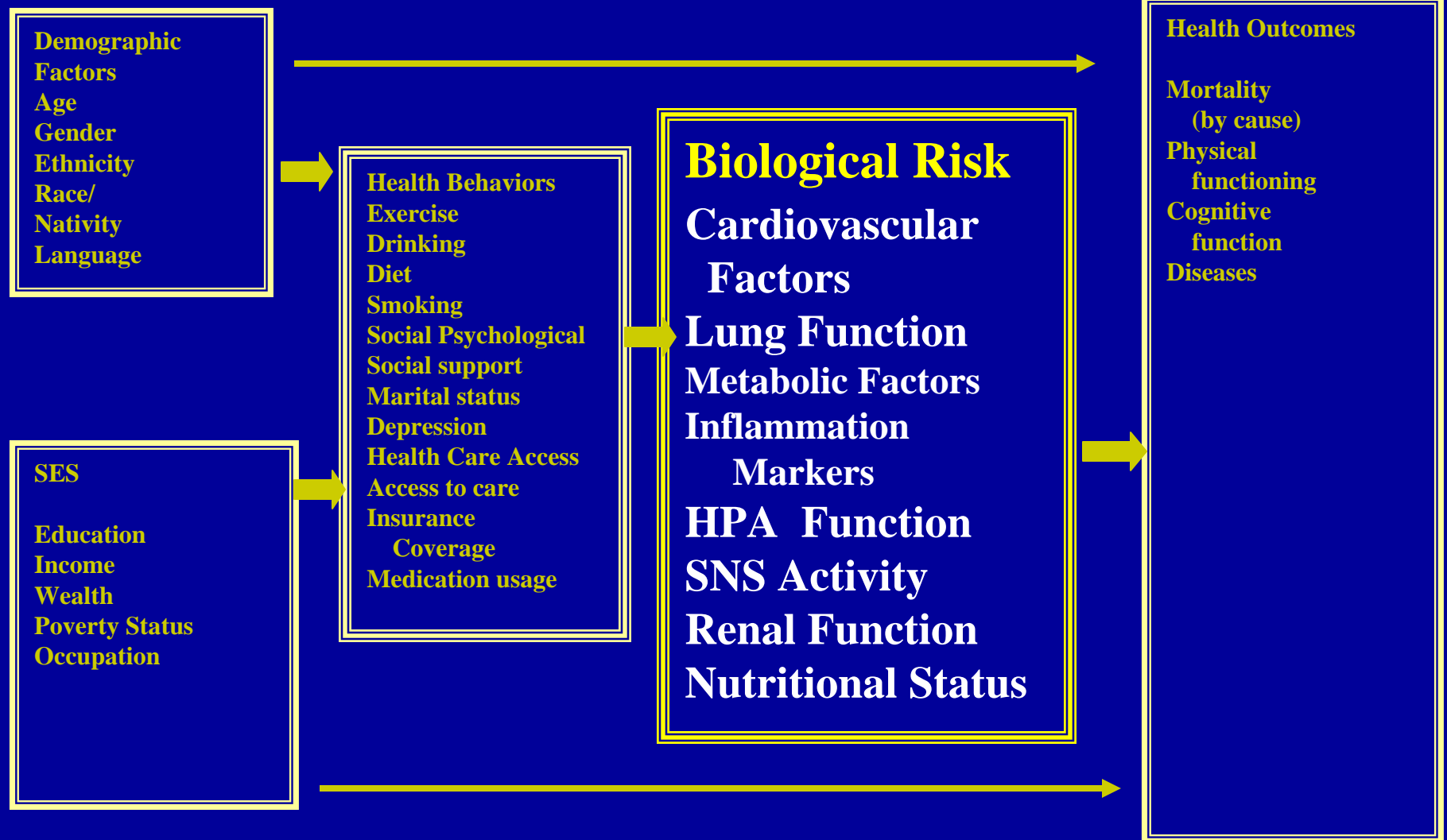
Education
Income
Wealth
Poverty
Occupation



Mediating Mechanisms Explaining Differentials and Trends



Biological Risk or Paths



Uses of Biological Data

- Provide information about the biological mechanisms or paths
- Provide information about earlier processes than disease or death
- Provide information respondent does not know
- Use same scale for everyone

National Samples

- **National sample – diversity, large numbers in subgroups**
- **We can compare the risk associated with a variety of biological, social and economic factors at the same time**
- **We do not expect to discover new biological relationships or risks for health outcomes (but we could find an interaction)**

What is measured

- is related to both why and how

- Risk factors known to be related to major health outcomes – high in prevalence
- Indicators of physiological states with significant influence on those outcomes
- What can be done under study/survey circumstances

Initial Operationalization of Allostatic Load - MacArthur

- **Cardiovascular**
- **HPA Axis**
- **Symp. Nerv. Sys**
- **Metabolism**
- **Resting Systolic, Diastolic BP**
- **Ur. cortisol (12 hr), DHEA-S**
- **Ur. Norepinephrine, epinephrine (12hr)**
- **Gly. Hemoglobin, HDL/total Cholesterol, WHR**

MacArthur - a few sites, in-home collection by phlebotomist, of urine 12 hour, blood

Cumulative Biological Risk: “allostatic load”

Life Experiences (Protective & Damaging)*



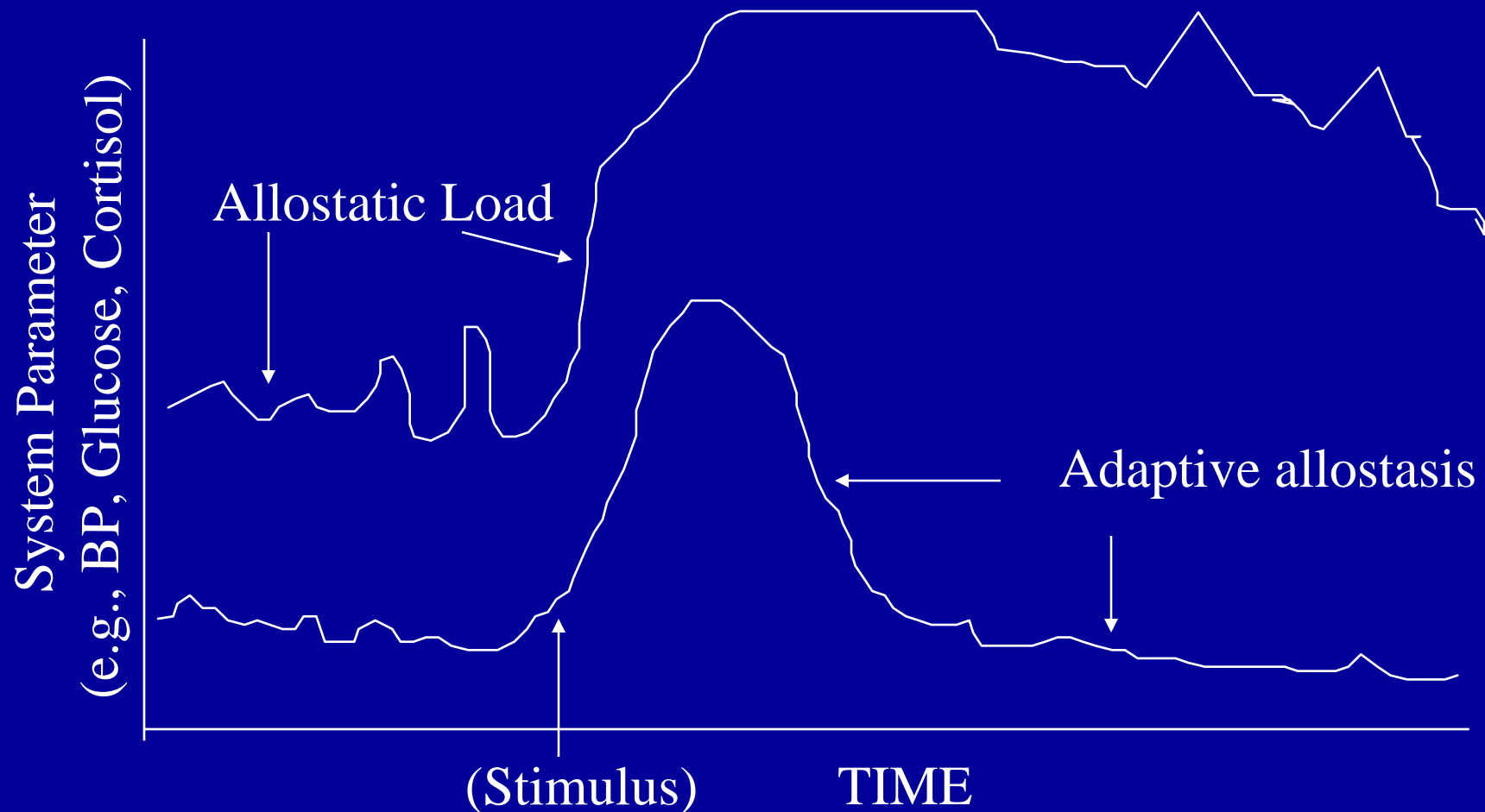
Biological “Aging”



Morbidity, Functioning,
Mortality

**Contextual effects - sex, ethnicity, socio-economic status?*

Adaptive Allostasis vs. Allostatic “wear & tear”



Biological Risk Components

➤ Cardiovascular Factors

- Systolic Blood Pressure
- Diastolic Blood Pressure
- Pulse
- Response to Exercise

➤ Metabolic Factors

- HDL Cholesterol
- Total Cholesterol
- Glycated Hemoglobin
- BMI / waist-hip ratio /waist
- Triglycerides
- Plasma Glucose
- Uric Acid

Lung Function – Peak Flow

Renal Function - Creatinine Clearance

➤ Vitamin/Antioxidant status

- Homocysteine/Folic Acid
- Vitamins, Beta Carotene

➤ Sympathetic Nervous System

- Epinephrine
- Norepinephrine

➤ Hypothalamic Pituitary Axis

- Urinary Cortisol
- DHEA-S

➤ Inflammation Markers

- Serum Albumin
- CRP
- Fibrinogen
- IL-6

➤ Genetic Differences

Health Consequences of Biological Risk

- Blood Pressure
 - CHD / Stroke / Cog. & Phys Impairments
- Metabolic Syndrome
 - Glucose: CHD/Cognitive/Physical & Vision Impairments
 - Lipids: CHD/ Cognitive

Health Consequences (cont'd)

- Inflammation
 - CHD/Cog & Phys Functioning/Mortality
- HPA Axis
 - Cog. impairment/Depression/CHD/
 - Immune Dysfunction
- SNS
 - CHD/Hypertension/Mortality

National Data

National Health and Nutrition Examination Surveys
(NHANES) – NCHS

Health and Retirement Survey (HRS) – David Weir, Mary
Beth Ofstadhal

National Social Life Health and Aging Project (NSHAP) –
Linda Waite, Stacy Lindau and Thom McDade

English Longitudinal Study of Aging (ELSA) – James
Banks

Mexican Family Life Survey (MxFLS) – Duncan Thomas,
Elizabeth Frankenberg, Luis N. Rubalcava and Graciela Teruel

Indonesian Family Life Study (IFLS)– John Strauss

Mexican Health and Aging Study (MHAS)– Beth Soldo
and Alberto Palloni

NHANES

NHANES

- **Cross sectional – except for passive followup of death, Medicare**
- **(NHANES 1 – actively followed)**
- **Collection done with trucks and many medical personnel for whole day**
- **Extensive measurement**
- **Half sample is fasted overnight**

NHANES Mobile Examination Center



Biomarkers in NHANES

- Hematology
- General Biochemistry Tests
- Antibody Tests
- Biochemistry Profile
- Diabetes Testing Profile
- Urine Tests
- Eye, Audiometry
- Blood Pressure, Chest, Heart
- Body Measures
- Periodontal Assessments
- Physical Functioning,
- Balance
- CV Fitness
- Cognitive Test, Reaction
- STDs

Biomarkers in NHANES III

Laboratory

- Hematology
- General Biochemistry Tests
- Antibody Tests
- Biochemistry Profile
- Diabetes Testing Profile
- Urine Tests

Exam

- Eye, Audiometry
- Blood Pressure, Chest, Heart
- Dermatitis
- Lower Extremities Joint Exam
- Breast Size and Tanner Staging
- Body Measures
- Periodontal Assessments
- Allergy Skin Test
- Cognitive Test, Reaction
- Physical Functioning

Biomarkers in NHANES 1999-2004

Laboratory

- **Metabolic:** Lipids, Urine collection, Urinary Iodine, Iron/TIBC, Albumin, Nutritional Biochemistries, Biochemistry/Hormones
- **Immunogenic:** CRP, Creatinine, Complete Blood Count, Methicillin-Resistant Staphylococcus Aureus, Erythrocyte Protoporphyrin, Hepatitis, Measles/Rubella/Varicella, Hematology, Phlebotomy, PSA

Laboratory

- **STDs:** HIV, Chlamydia/Gonorrhea, Herpes I & II, Syphilis/Treponema Pallidum, Trichomoniasis/Vaginalis/Bacterial Vaginosis
- **Toxicology:** PHPYPA Urinary Phthalates, Pesticides, Dioxins, Heavy Metals, Toxoplasma, Lead Dust

Exam

- Audiometry, Vision
- Body Measurements
- Blood Pressure, CV Fitness
- Dietary
- Physical Functioning, Balance
- Oral Health

HRS

Reasons For and Against Adding Biomarkers

- **Against**
 - Ongoing survey with valuable longitudinal data and people might not want to be asked for something new and they will drop out of the entire survey
 - People will be overburdened as the interview is already very long
 - It will cost a lot of money
- **For**
 - Scientific reasons
 - ELSA did it
 - Technology available
 - Subsamples for ADAMS and Diabetes studies were successful

HRS 2006 – Face to Face Interview-Interviewer (1//2 sample) – No fasting

- **Measured height, weight, and waist**
- **Blood pressure**
- **Performance measures – timed walk, grip strength, puff test, balance test**
- **Salivary DNA for repository**
- **Dried Blood Spots – Glycosylated hemoglobin, total cholesterol and HDL, C-reactive protein +**

Technology

- **DNA – Saliva (HRS - Scope Mouthwash), buccal swabs (used in ADAMS and Denmark), blood**
- **Dried Blood Spots (HRS - DBS) – Thom McDade**
- **Meters – Glucometer, hemocue**



FORM
REGISTRATION
STUDY CENTER

Form with a red biohazard symbol and various fields for registration information.

Form with a red biohazard symbol and various fields for registration information.

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EMERGENCY

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REGISTRATION

Form with a red biohazard symbol and various fields for registration information.



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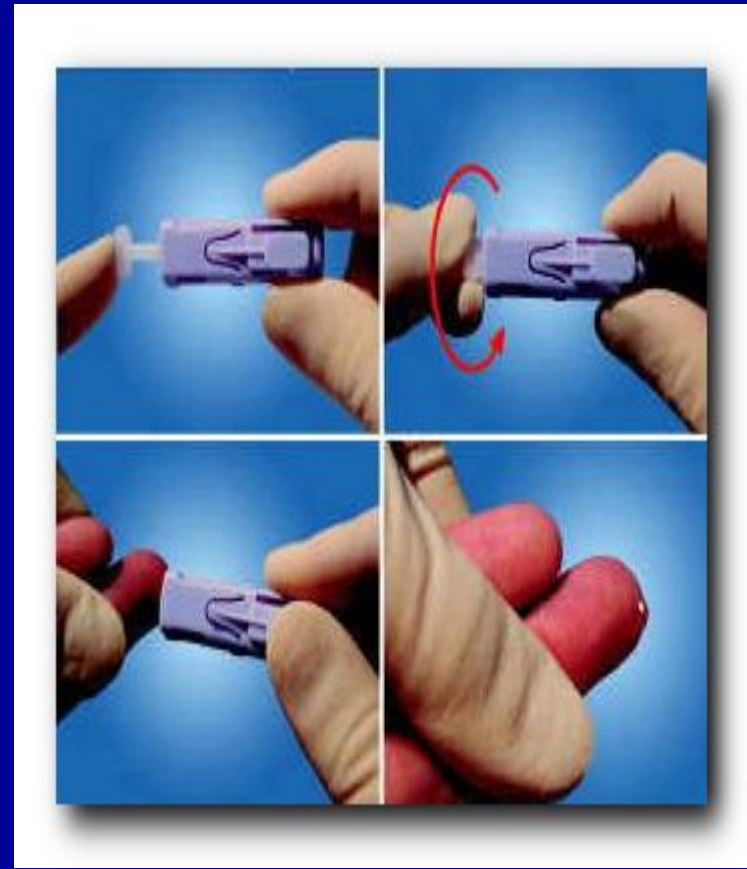
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REGISTRATION

Form with a red biohazard symbol and various fields for registration information.

Saliva Collection Device



Lancet for cutting finger for DBS



Cutting Punches from Guthrie Dried Blood Spot Card

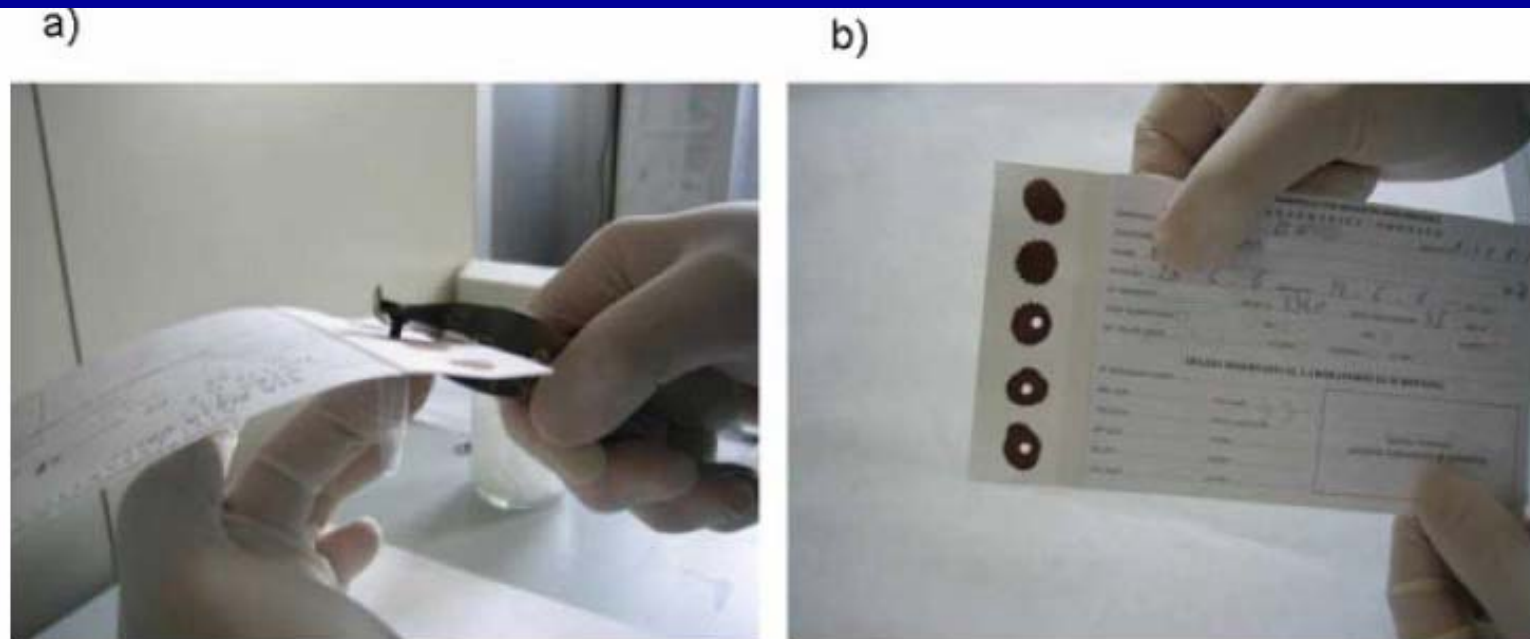


Figure 1. Cutting punches from a Guthrie card

Source: Barbi, Binda, and Caroppo (2006). Diagnosis of congenital CMV infection via dried blood spots. *Rev. Med. Virol.*, 16: 385-392

Issues

- **Labs – Assay values will vary**
 - Need documentation to make comparisons across assays
- **Assays – Many are not done by hospital labs regularly (hsCRP – IL-6)**
- **Instrumentation – Blood pressure can be taken by a person or a machine**

HRS Preliminary Results – 2006 Interview

- **Slides on participation prepared by Mary Beth Ofstadhal**
- **Slides on results prepared by David Weir**
- **Presented June 5th at the Co P.I. meeting**
- **Do not cite these results without permission of Ofstadhal or Weir**

Informed Consent

- Booklet is 12 pages
- Each set of tests has its own consent and tests are done before moving to next consent
- Physical Performance – measurement of blood pressure, ht/weight/waist, puff test, walk, balance, grip strength
- Saliva – for DNA
- Blood spots
- Permission in two stages – known tests, stored for future use

HRS - Dried Blood Spots

- HRS – Still in process –
- CRP
- Others available from one spot at the same time? Serum Amyloid A, cystatin-C, Epstein-Barr or CMV
- Thomas McDade, Sharon Williams, J.Josh Snodgrass. What a drop can do: Dried blood spots as a minimally-invasive method for integrating biomarkers into population-based research. Demography. Forthcoming.

ELSA

- Nurse – every other visit – 4 years
- Blood pressure, lung function, anthropometric measures (height, weight, waist, hip)
- Blood - haemoglobin and ferritin, inflammatory markers of C-reactive protein and fibrinogen, lipids, fasting lipids, fasting glucose, and glycated haemoglobin.
- Physical functioning was assessed using balance tests, timed chair stands, and grip strength
- Cortisol from saliva samples taken over one day and accompanied by a diary
- Extraction of DNA for a genetic repository.

NSHAP Biomarkers

- **Physical measures: Height, Weight, Blood pressure, Pulse**
- **Sensory function: Smell, Touch, Taste, Vision**
- **Get up and go**
- **Assays collected: Bacterial vaginosis, Vaginal cell cytology, HPV, Yeast vaginosis, Cotinine, DHEA, Estradiol, HIV, Progesterone,**
- **Testosterone, CRP, EBV**
- **Glycosylated hemoglobin (HbA1c)**
- **Hemoglobin**

ADDHEALTH

- Height
- WeightChlamydia
- Gonorrhea
- Trichomoniasis
- HPV

- **MxFLS** 2002 - anthropometry, hemoglobin levels (meter) and blood pressure - 2005 – blood spots
- **IFLS** – blood pressure, anthropometry, dried blood spots (2007)
- **MHAS** – Blood pressure, anthropometry, performance measures

New Measurement (??)

- TILDA - **Magic Carpet** to measure balance
- David Wong – Future RNA with saliva (genetic) markers that are indicators of disease
- Arthur Stone – Monitors of daily activity level
- Telephone monitoring of cardiovascular risk factors

Magic Carpet



Portable Sonogram



Portable ECG



Ecological Momentary Assessment (EMA)

- **Signals participants to report on current psychological, behavioral and environmental states**
- **Signaling through a small electronic device (e.g. paging devices, palmtop computers, programmable wristwatches)**
- **Reduces biases related to retrospective recall**

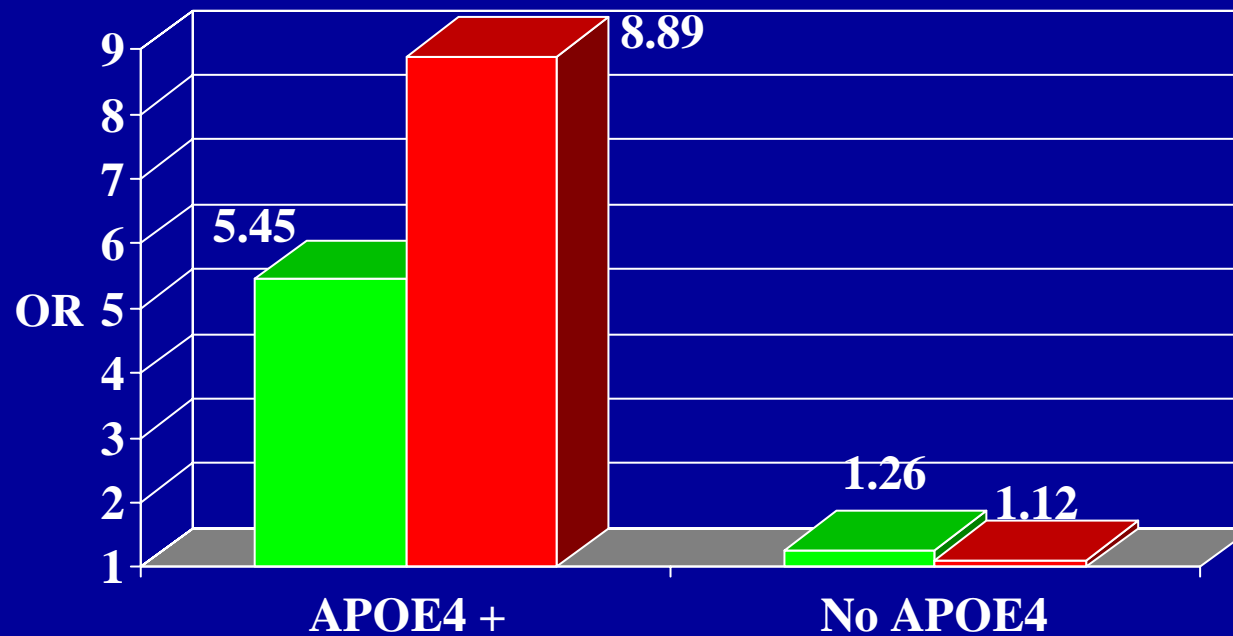
Future Directions: New Biological Parameters

- **Metabonomics - metabolic profiles**
- **Proteomics**

Genes

- **Modulations of genotype risks**
 - By demographic characteristics, social factors, behaviors (e.g., exercise, smoking)
 - other genetic and biologic social factors
- **DNA expression, damage**
 - (telomere length, mitochondrial damage) –

APOE, Antioxidants & Cognitive Decline: effects of low serum beta-carotene



Odds of Cog. Decline for Low vs. High Antioxidant Levels

■ adj demos ■ Adj all

Hu, P., et al. . (2006). The association between serum beta-carotene levels and decline of cognitive function in high-functioning older persons with or without Apo E 4 Alleles: MacArthur Studies of Successful Aging. *Jourl of Geronty: Medl Sci*, 61, 616-620.

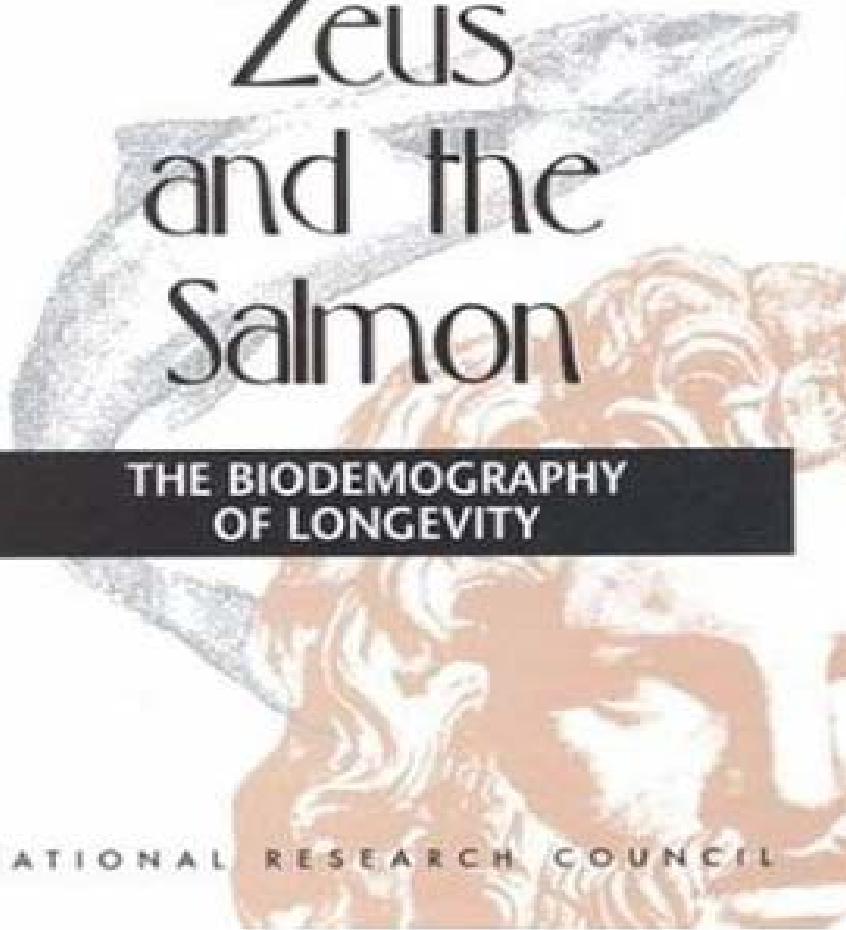
"Adj demos" model = 1988 SPMSQ, age, sex, race, ed, income,

"Adj all" = demos + smoking. Alcohol, CRP, IL-6, total & HDL cholesterol, BMI

Future Directions -New Population data

- **Cross national studies of populations at different levels of socioeconomic development and different disease environments to clarify the relative role of different types of biological risk under different circumstances**
- **Studies across the age range to clarify the effects over the lifespan of biological risk**

Between Zeus and the Salmon




THE BIODEMOGRAPHY
OF LONGEVITY

NATIONAL RESEARCH COUNCIL

NATIONAL RESEARCH COUNCIL

Cells and SURVEYS

Should Biological Measures Be
Included in Social Science Research?



The End

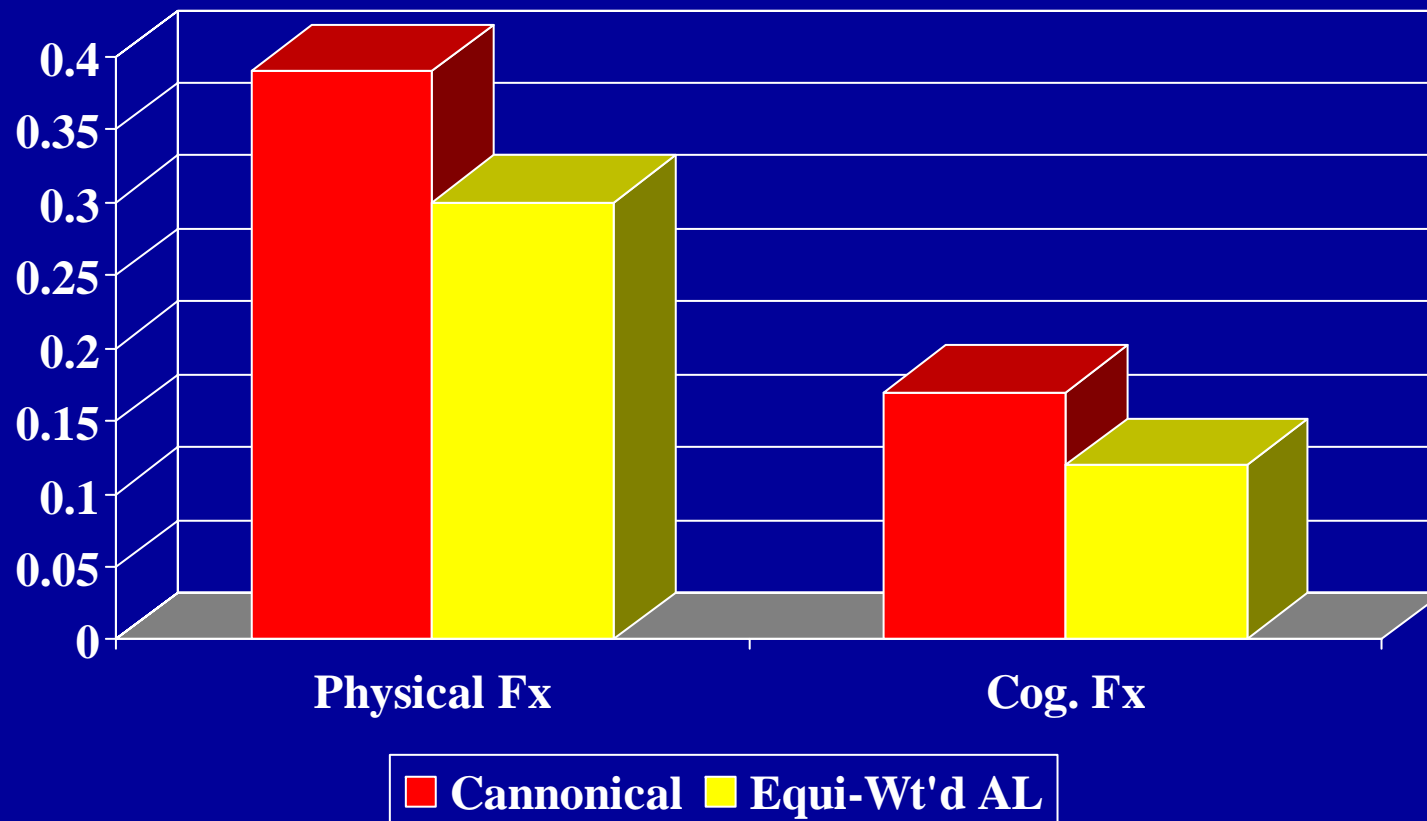
Summary Measures of Allostatic Load

- Original Equi-weighted (for each of 10 parameters)
 - Identify scores in top quartile of risk
 - Count number of parameters for which subject has a score in top quartile.
- Cannonical Correlation based scoring
 - For each parameter:
 - Use raw scores (i.e., full range of scores)
 - Weight by cannonical weight

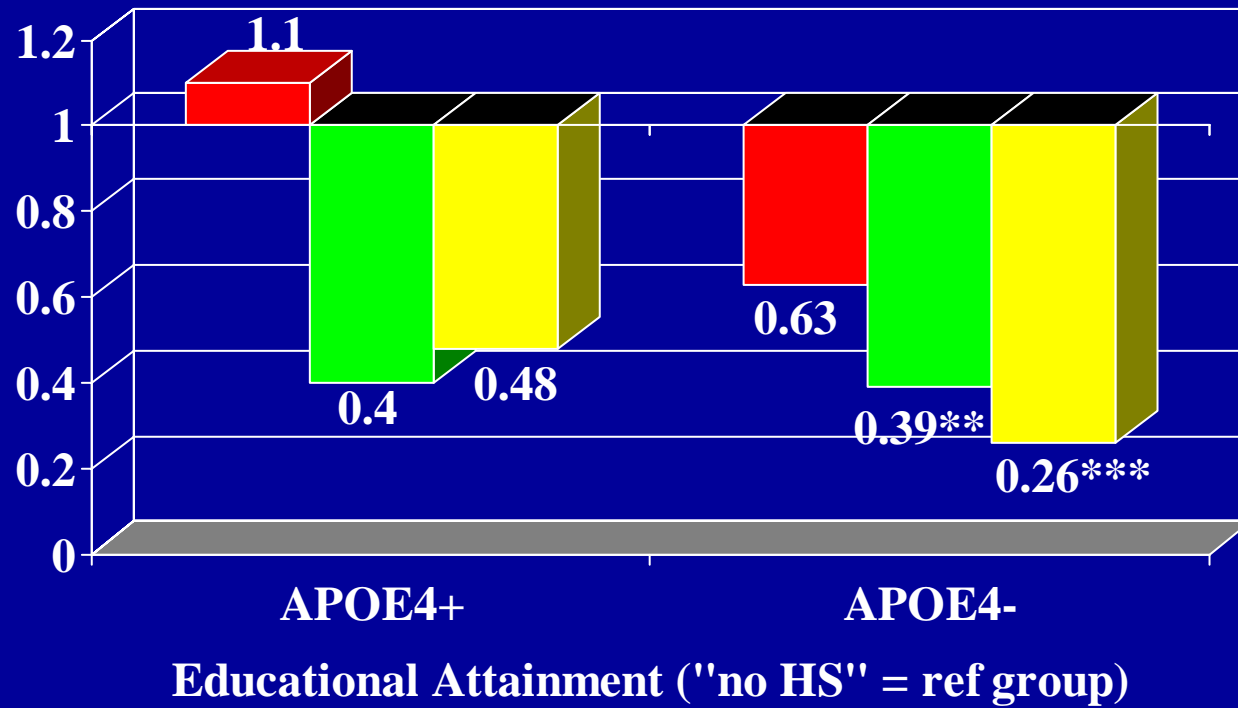
Range of Scores
(0-10)

Range of Scores
(5.2-10.4)

Original AL score vs. Cannonical score - Correlations with 7-yr change in function



APOE & Education



■ Some HS ■ HS ■ >HS

APOE & Cognitive Decline [SPMSQ] (1988-'95)

