

National Health and Nutrition Examination Survey: Overview

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Unlocking NHANES: Content, Applications, and Analysis of the
National Health and Nutrition Examination Survey Data

July 22, 2020

Outline

- ❑ Goal & History
- ❑ Overall Design
- ❑ How Data Collected
- ❑ How Data Used
- ❑ Analytic & Methodologic Considerations
- ❑ Latest Update

<https://www.cdc.gov/nchs/nhanes/>

Goal & History

National Health and Nutrition Examination Survey (NHANES)

“NHANES is ... designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interviews and physical examinations.”

https://www.cdc.gov/nchs/nhanes/about_nhanes.htm

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NHANES provides

❑ U.S. population-based estimates of:

- Health conditions
 - Awareness, treatment and control of selected diseases
- Nutrition status and diet behaviors
- Environmental exposures

Most collected data available for free download

More uses other than producing these estimates

Evolution of NHANES

<i>Survey</i>	<i>Dates</i>	<i>Ages</i>
NHES I	1960-62	18-79 years
NHES II	1963-65	6-11 years
NHES III	1966-70	12-17 years
NHANES I	1971-75	1-74 years
NHANES II	1976-80	6 mo.-74 years
HHANES	1982-84	6 mo.-74 years
NHANES III	1988-94	2 mo. +

Evolution of NHANES (cont'd)

Continuous since 1999 with 2year cycle

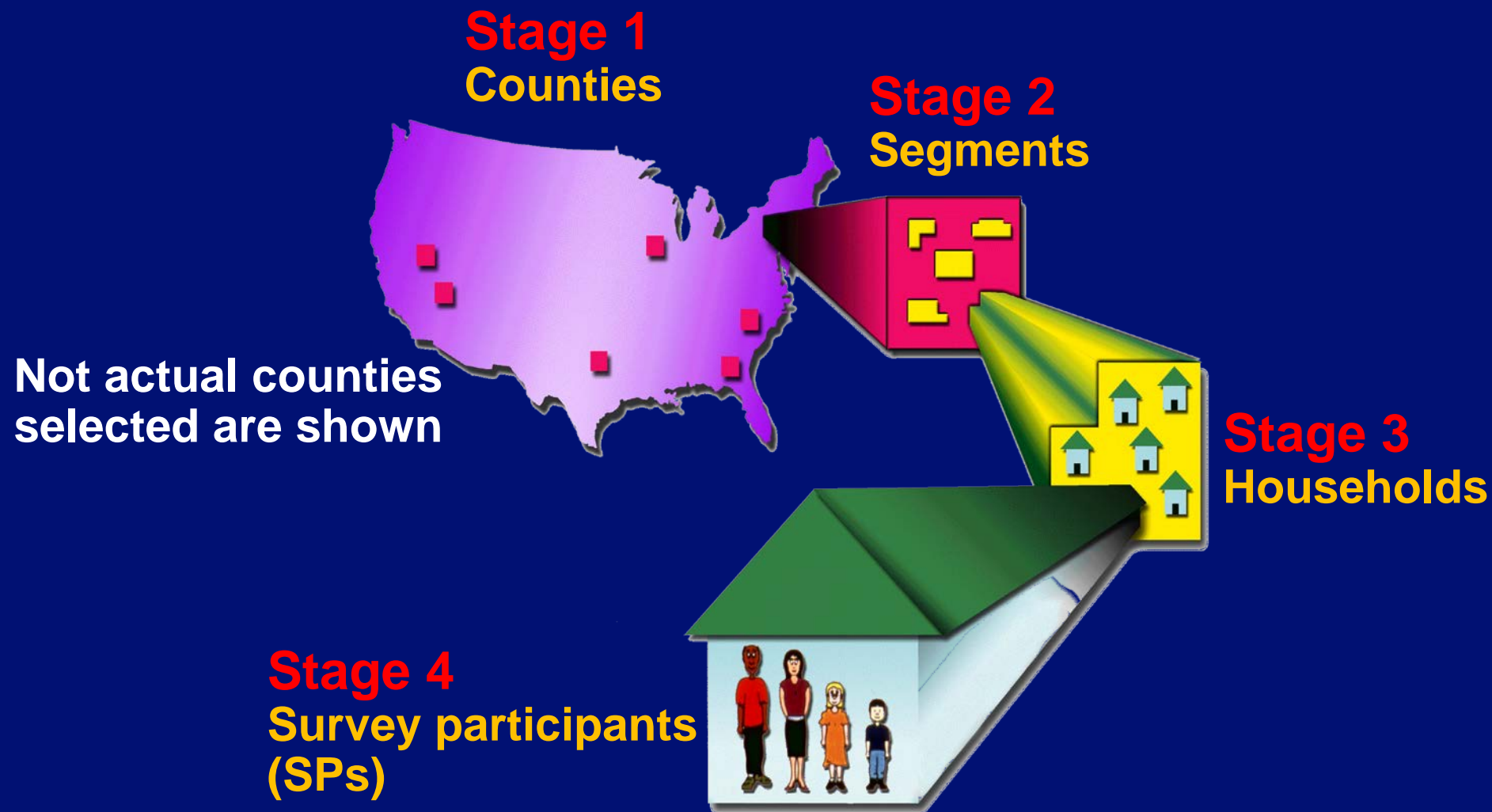
Cycles	Ages
1999-2000	All ages
2001-2002	
2003-2004	
2005-2006	
2007-2008	
2009-2010	
2011-2012	
2013-2014	
2015-2016	
2017-2018	

Overall Design

NHANES Sample

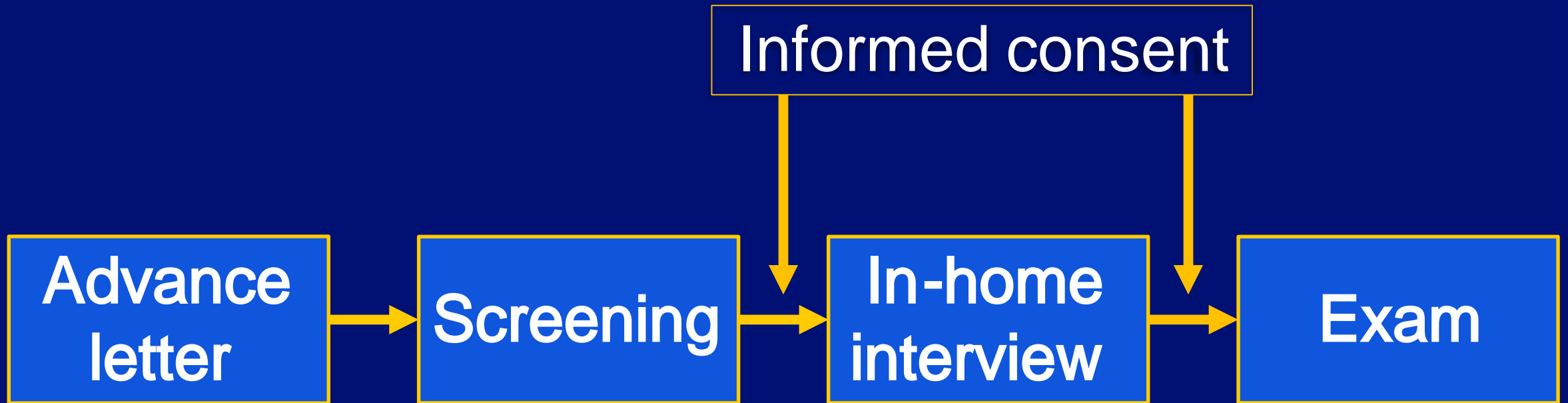
- ❑ Represents US civilian, non-institutionalized population residing in 50 states & DC
- ❑ About 5,000 people sampled each year
- ❑ Oversampling: to allow reliable estimation for subgroups
 - Hispanics
 - Non-Hispanic blacks
 - Older persons aged 80+
 - Low income whites
 - Non-Hispanic Asians (as of 2011)

NHANES Sampling Procedure



Data Collection

Data Collection Steps



Household Contact

- ❑ Doorstep screening
- ❑ Traditional Computer-Assisted Personal Interview (CAPI) interviewing



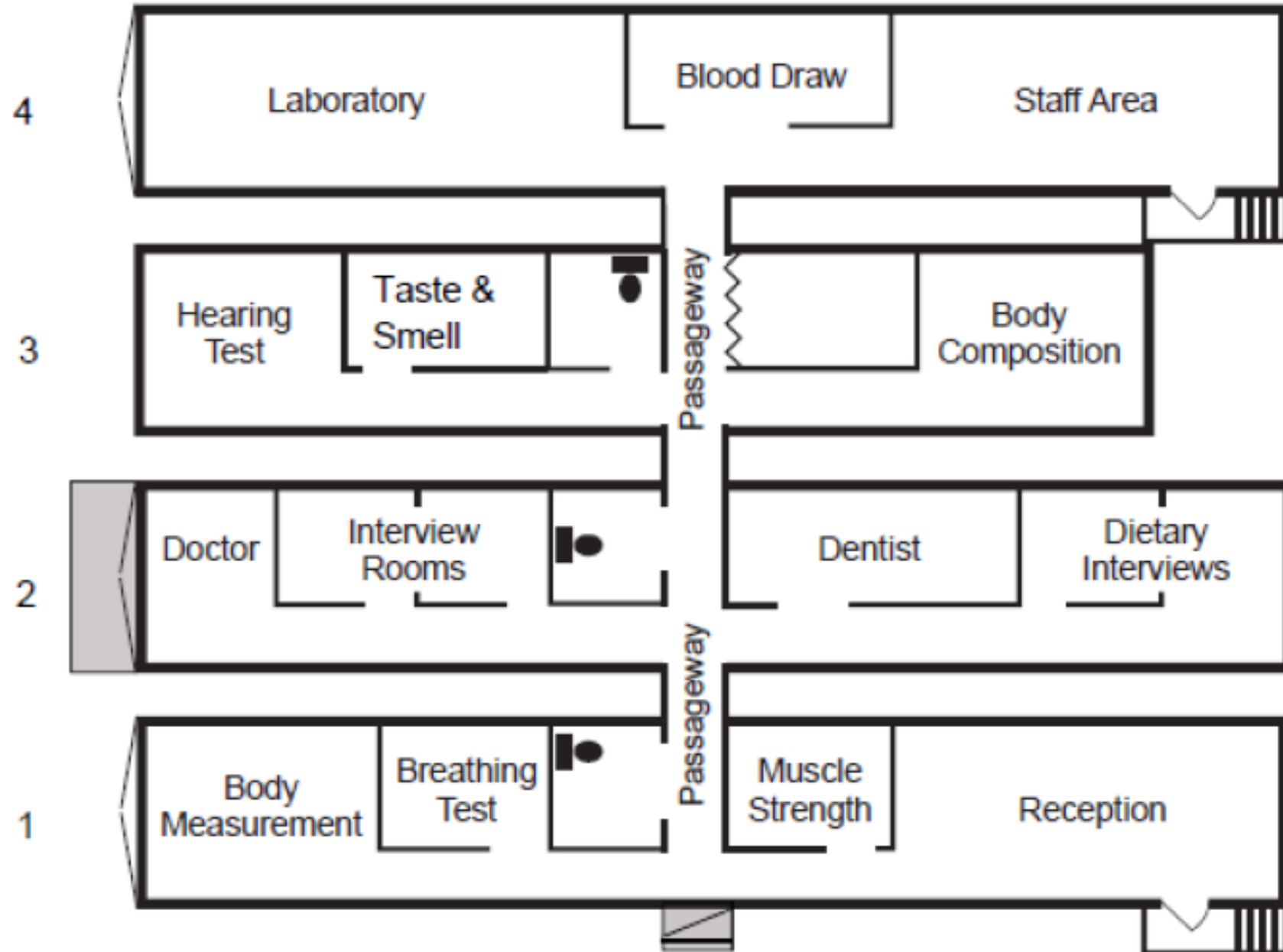
Household Interview

- ❑ Various health conditions
- ❑ Health-related behaviors and exposures
- ❑ Health care utilization
- ❑ Prescription medications
- ❑ Dietary supplements

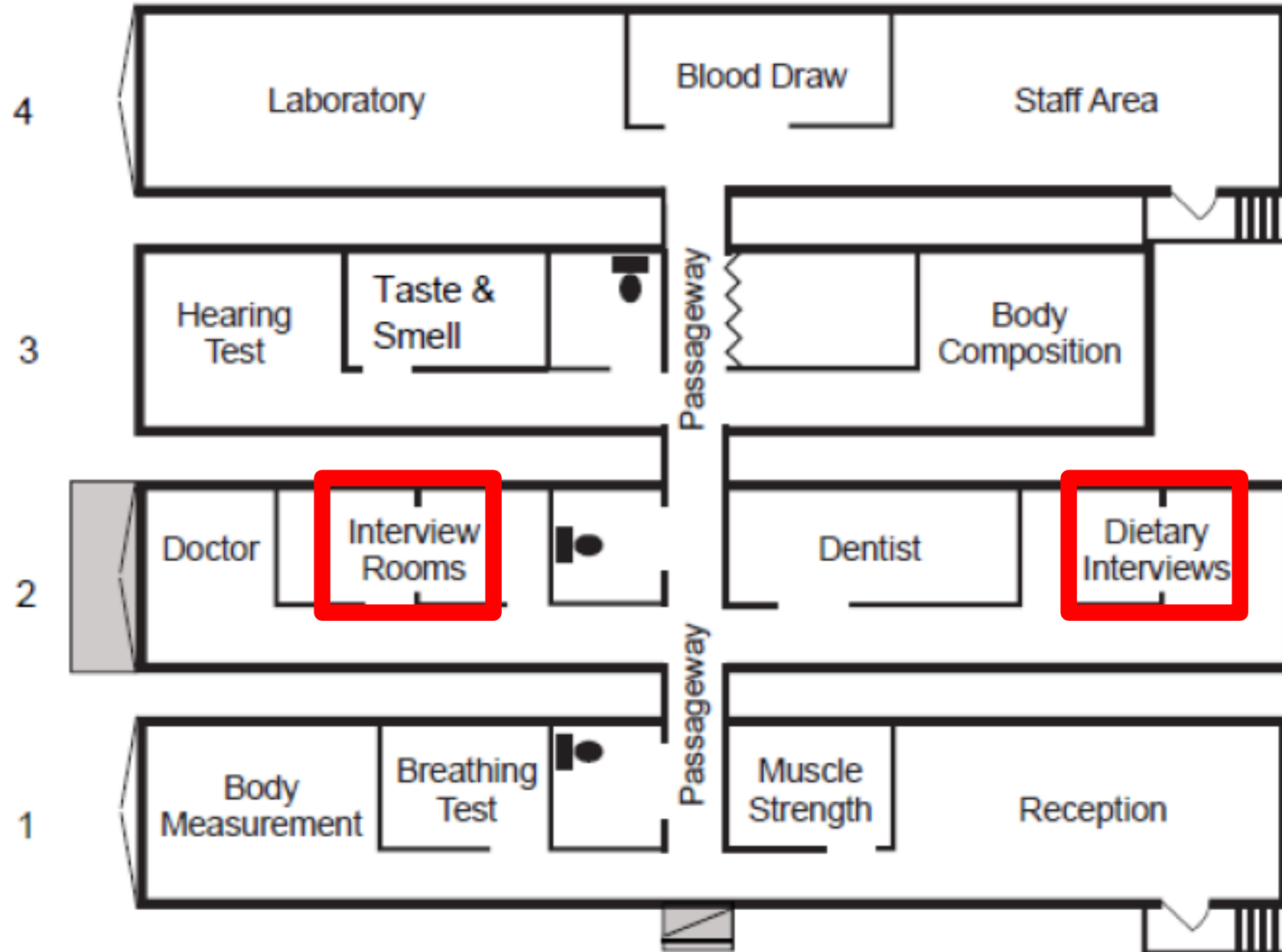
Mobile Exam Center (MEC)



Mobile Examination Center (MEC) Diagram



Mobile Examination Center (MEC) Diagram



Quick virtual tour of MEC

**Some components not performed
every survey cycle**

Reception



Cardiovascular Health



Hearing and Vision



Anthropometry and Body Composition



Whole Body Scan



Muscular Strength



Private Interviews



Oral Health



Respiratory Health



Laboratory



Laboratory tests

□ In MEC

- Pregnancy test
- Complete blood count

□ CDC and other labs

- ~500 assays

Laboratory Tests (cont'd)

- ❑ Biochemistry profile
- ❑ Nutritional biomarkers
- ❑ Diabetes
- ❑ Lipids, CRP
- ❑ Hormone tests
- ❑ Infectious diseases
 - Hepatitis
 - STDs
 - MRSA
 - H. Pylori

Laboratory Tests (cont'd)

□ Environmental Exposures:

- Metals
- Pesticides
 - Organophosphates
 - Organochlorines
 - Pyrethroids
 - Fungicides
 - Herbicides
- Phthalates
- Polycyclic aromatic hydrocarbons (PAHs)
- Perchlorate
- Volatile organic compounds
- Acrylamide
- & many more

□ Some measured in pooled samples

Exploring Data Availability

- ❑ Search variables
- ❑ Browse NHANES website

National Center for Health Statistics



🏠 National Health and Nutrition Examination Survey

About NHANES



What's New



Questionnaires, Datasets, and
Related Documentation



Survey Methods and Analytic
Guidelines

Search Variables

Frequently Asked Questions

All Continuous NHANES



NHANES 2019-2020



NHANES 2017-2018



National Health and Nutrition Examination Survey

Survey Participants



If you were selected,
learn more about
participating

Survey Data and Documentation



Access data,
documentation &
response rates

Publications and Products



View health and
nutrition reports & CDC
Growth Charts

Data Analysis Tutorials



Review step-by-step
guidance on using
NHANES data

What's New


Publications

- [Prevalence of Prescription Pain](#)

National Center for Health Statistics

CDC > NCHS > National Health and Nutrition Examination Survey > Questionnaires, Datasets, and Related Documentation



 National Health and Nutrition Examination Survey

About NHANES +

What's New +

Questionnaires, Datasets, and Related Documentation -

Survey Methods and Analytic Guidelines

Search Variables

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All Continuous NHANES +

NHANES 2019-2020 +

NHANES 2017-2018 +

NHANES 2015-2016 +

NHANES 2013-2014 +

NHANES 2011-2012 +

NHANES 2009-2010 +

NHANES 2007-2008 +



National Health and Nutrition Examination Survey

Search Variables

NOTE: This search only contains Continuous NHANES (1999 and on) variables that have documentation published, and does not include multiply imputed Dual Energy X-Ray Absorptiometry variables.

Variable Keyword Search

This simple keyword search will match your search term when contained in the Variable Name, Variable Description, SAS Label, and/or Data File Name.

Search Term	<input type="text"/>
Fields to Search	All ▾
Sort By	Variable Name ▾
Include Limited Access Variables	No ▾
Release Cycle	All ▾
Search Result Page Size	50 ▾

Search

National Center for Health Statistics



🏠 National Health and Nutrition Examination Survey

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Specimens for Future Research

- ❑ Serum
- ❑ Plasma
- ❑ Urine
- ❑ DNA (Age 20+ years)

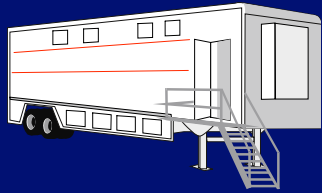
Stored with separate consent

How Long is the Exam?

- ❑ Adults and teens: 3.5 hours
 - Average—may take longer
- ❑ Children: 1-2 hours

Participants' benefit?

Results



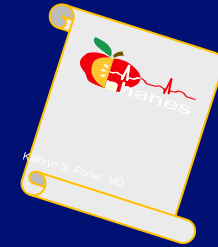
**Initial
findings**



**Abnormal
values**



**Call for STD
results
w/ pre-set
passwords**



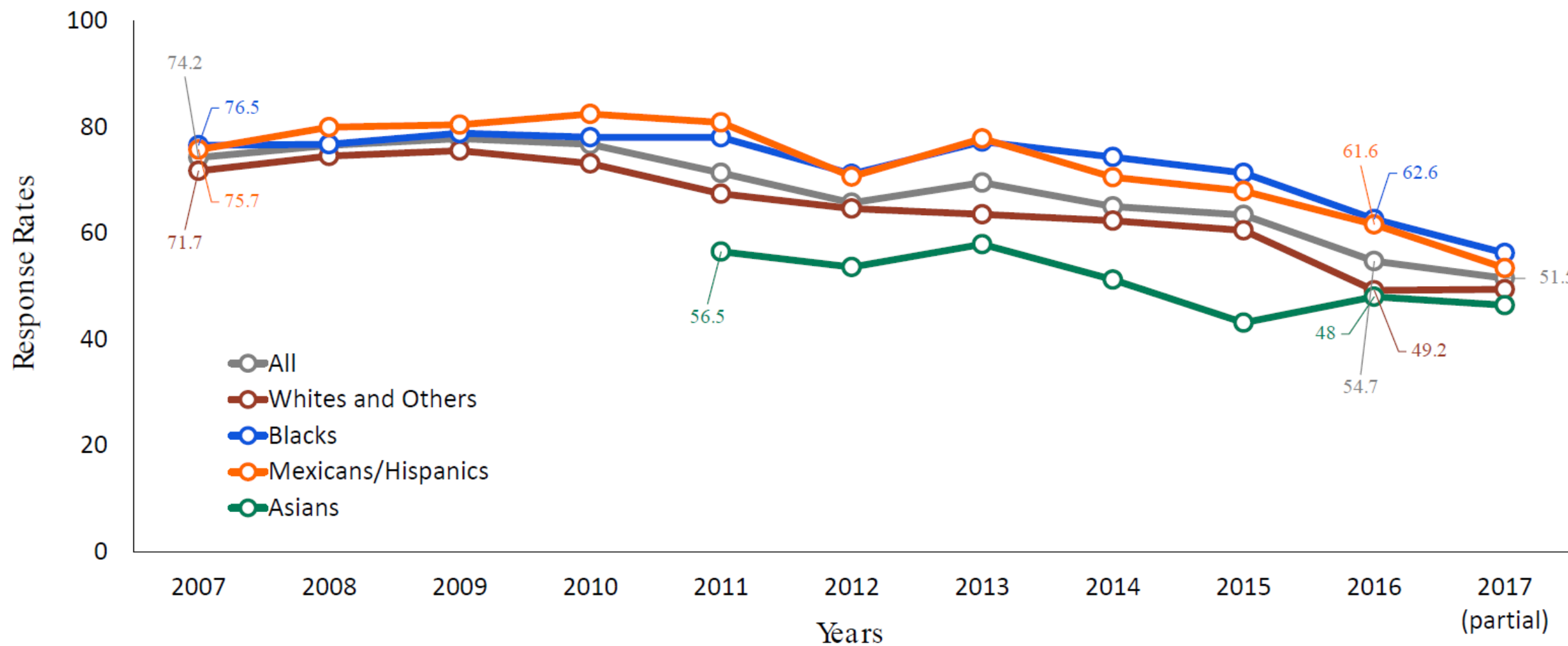
**Final
report**

Remuneration

- ❑ Cash remuneration for time and effort
- ❑ Transportation (bus, taxi, mileage) reimbursed
- ❑ Non-participant parent receives remuneration for child
- ❑ Additional remuneration for other components

Trends in Response Rates by Race and Hispanic Origin

NHANES 2007 to 2017

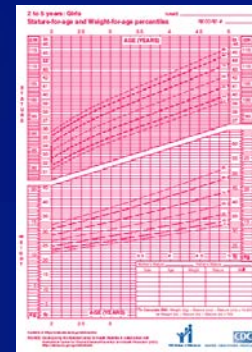
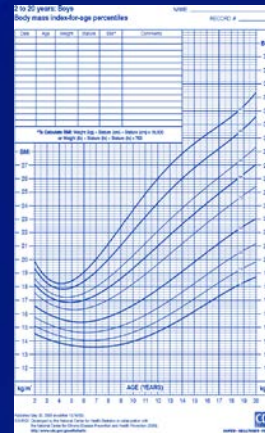


Source: https://www.cdc.gov/nchs/data/bsc/bscpres_fakhouri_january_2018.pdf

How Data Used

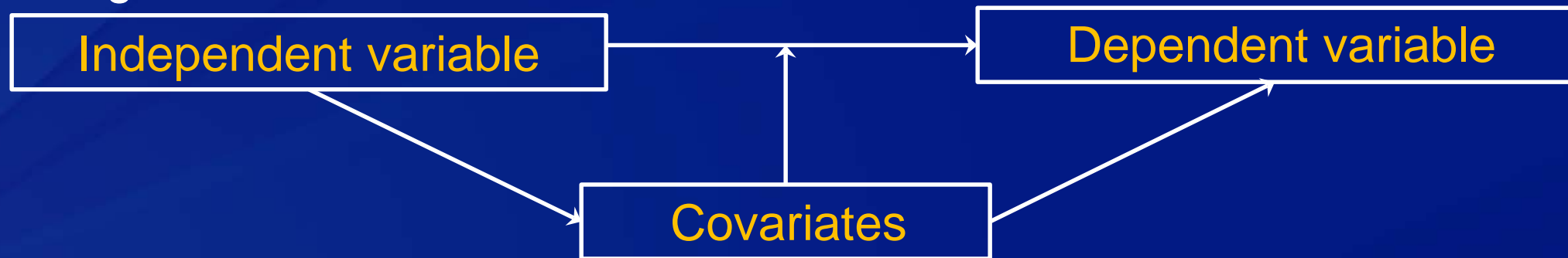
Few NHANES Contribution Examples

- ❑ Pediatric growth charts
- ❑ Blood pressure
 - Guidelines
- ❑ Blood lead
 - Current CDC “Reference value” (5 $\mu\text{g}/\text{dL}$) for age 1-5
 - ← NHANES 2007-2010
- ❑ 132 Healthy People 2020 Objectives
- ❑ Many more

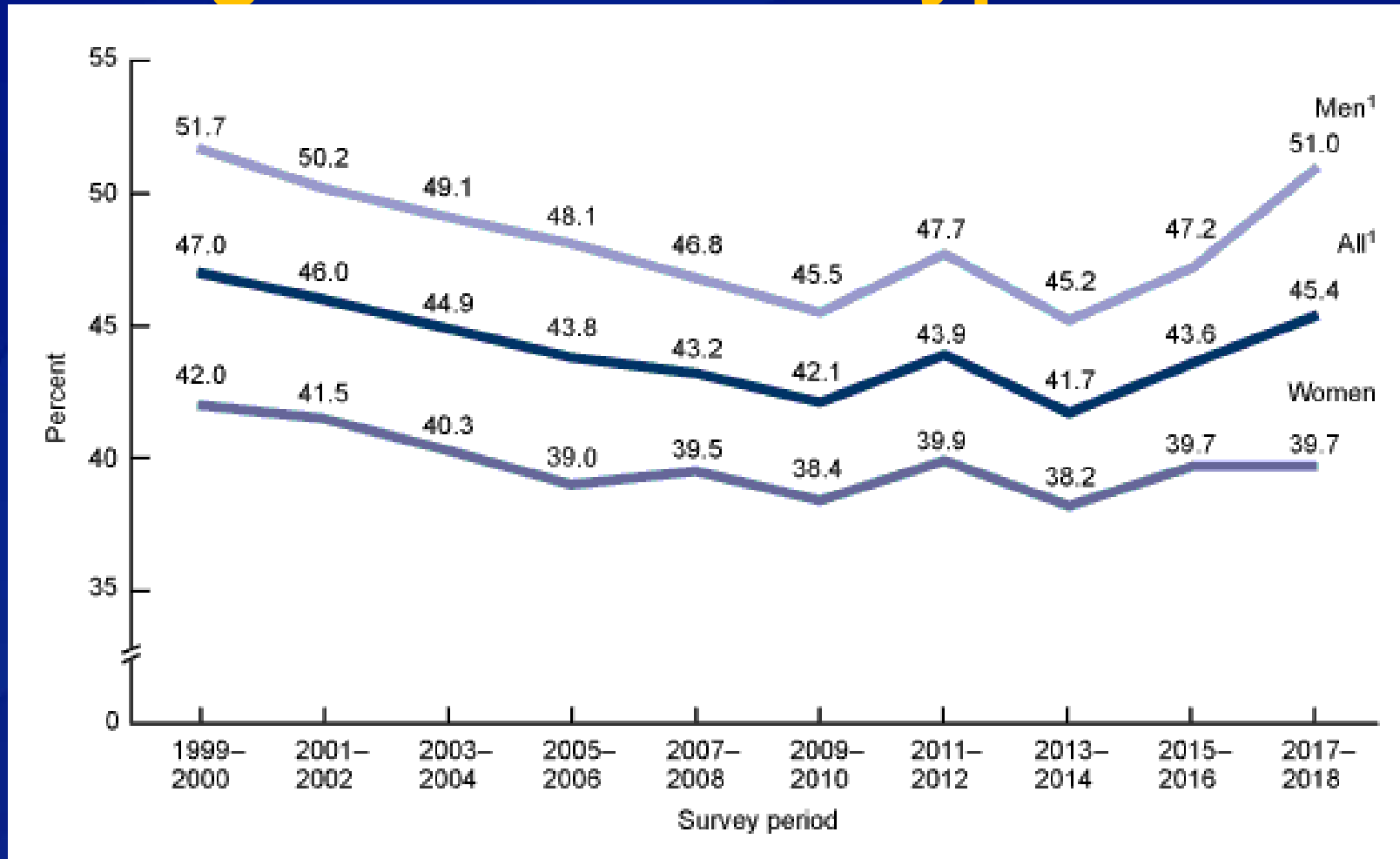


Types of NHANES-based Studies

- ❑ Descriptive vs. Analytical
- ❑ Context, e.g.:
 - Change over time
 - Compare by group, e.g., minority, demographic, SES
- ❑ Design
 - Cross-sectional
 - Longitudinal



Change Over Time: Hypertension



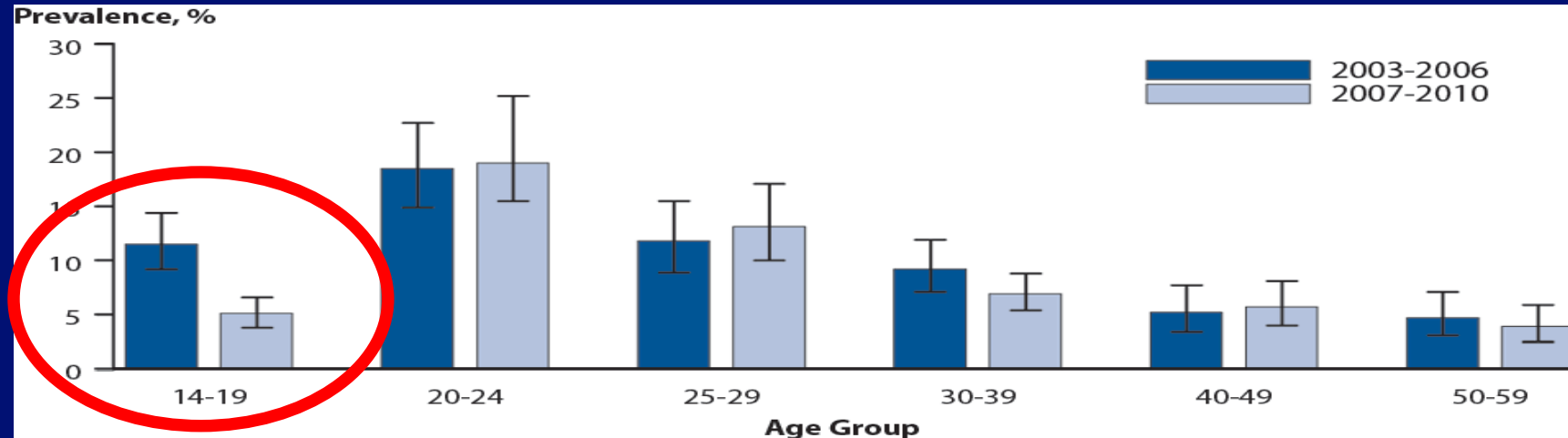
SOURCE: Ostchega Y, Fryar CD, Nwankwo T, Nguyen DT. Hypertension prevalence among adults aged 18 and over: United States, 2017–2018. NCHS Data Brief, no 364. Hyattsville, MD: National Center for Health Statistics. 2020.

Change Over Time: HPV

The New York Times

Health

HPV Vaccine Is Credited in Fall of Teenagers' Infection Rate



SOURCE: Markowitz LE, et al. Reduction in human papillomavirus (HPV) prevalence among young women following HPV vaccine introduction in the United States, National Health and Nutrition Examination Surveys, 2003–2010. J Infect Dis 2013;208(3):385–93.

Group Comparison: Cross-sectional

AJPH RESEARCH

Housing Assistance and Blood Lead Levels: Children in the United States, 2005–2012

Katherine A. Ahrens, PhD, Barbara A. Haley, PhD, Lauren M. Rossen, PhD, Patricia C. Lloyd, PhD, and Yutaka Aoki, PhD

Longitudinal With Linked Mortality Data

Medicine[®]

OBSERVATIONAL STUDY

OPEN

Blood Lead and Other Metal Biomarkers as Risk Factors for Cardiovascular Disease Mortality

Yutaka Aoki, PhD, Debra J. Brody, MPH, Katherine M. Flegal, PhD, Tala H.I. Fakhouri, PhD, Daniel A. Axelrad, MPP, and Jennifer D. Parker, PhD

Analytic & Methodologic Considerations

Tips for NHANES-based research

General Process

- ❑ **Search for topic ↔ Learn NHANES data**
 - What has been researched properly
 - What can be researched properly→ “Unbeaten path”
- ❑ **Learn complex survey method**
 - Take (short) course or self-teach
 - Online tutorials → NHANES website
- ❑ **Practice—replicate previous findings**
- ❑ **Consider use of limited-access data**

Strengths and Limitations

□ Strengths

- Nationally representative
- Consistent data collection
- (Lots of data for free!)

□ Limitations

- Limited local estimation (15 locations/year for 1999-present)
 - No geography at state level or below disclosed
 - Only exceptions: State of California and Los Angeles County
- Sample size reduced for subgroup analysis
- Top-coding (age) and other data “masking”
- Declining response rates

Analytic Considerations—Just Two

❑ Top-coding, e.g., for age

- Solutions: (1) categorize; (2) impute; (3) limited access age; etc.

❑ When analyzing data from > 1 survey cycle:

- Confounding due to year of survey, e.g.:
 - Decreasing time trend both for X & Y
 - $X \leftrightarrow Y$ although no association within each survey cycle
- Solution
 - Adjust for survey cycle—include survey cycle indicators

❑ More...

Complex Survey Data Considerations

- ❑ **Avoid using methods for simple random sample**
 - Unless justified
 - Complex survey-appropriate extensions usually available
- ❑ **Two important design considerations**
 - Weighting
 - Variance estimation (strata and PSU)
- ❑ **Implementation relatively simple**

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`svyset sdmvpsu [pw=wtmec2yr], strata(sdmvstra)`
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```


Limited-Access (Restricted) Data

- ❑ **“Accessible” through Research Data Center (RDC)**
 - Some data may be used only as matching variable(s) for merge
- ❑ **Process**
 - Submit proposal to be reviewed on disclosure grounds
 - Conduct analyses at RDC
 - Retrieve results (“output”) acceptable on disclosure grounds
 - No raw data leaves RDC
- ❑ **Some user fees**
- ❑ **Many RDC locations including DC, Rockville, & Hyattsville**
- ❑ **RDC may be closed during COVID-19 epidemic**

Types of Limited-Access Data

- ❑ **“Sensitive” data, e.g.:**
 - Drug use for adolescents
 - ❑ **Personally/geographically identifiable information, e.g.:**
 - Exact age over 80
 - Detailed ethnic origin or ancestry
 - Geocode—matching variable for merge with external data
 - No geographic identifier at state or lower level directly accessible at RDC
 - ❑ **Linked administrative data**
 - Mortality
 - Medicare, Medicaid, Social Security Benefit
 - Housing Assistance Program (HUD)
- } Longitudinal study

Latest Update

Latest Update

- ❑ Field operation on pause due to COVID-19 epidemic
- ❑ Meanwhile...

NHANES provides truck to D.C. for COVID-19 response



More information

❑ NHANES Website

- <https://www.cdc.gov/nchs/nhanes/>

→ Explore variables, learn about design/analysis, use tutorials...

❑ General inquiries: CDC-INFO email form

- <https://www.cdc.gov/cdc-info/index.html>

→ Recommended method for inquiry

❑ Contact

- yaoki@cdc.gov

Thank you!

