NHANES:

TYPES OF RESEARCH SUPPORTED BY THE CURRENT SURVEY DATA

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December 2, 2022

CASE WESTERN RESERVE UNIVERSITY EST. 1826

CLEVELAND INSTITUTE FOR COMPUTATIONAL BIOLOGY

National

Health

And

Nutrition

Examination

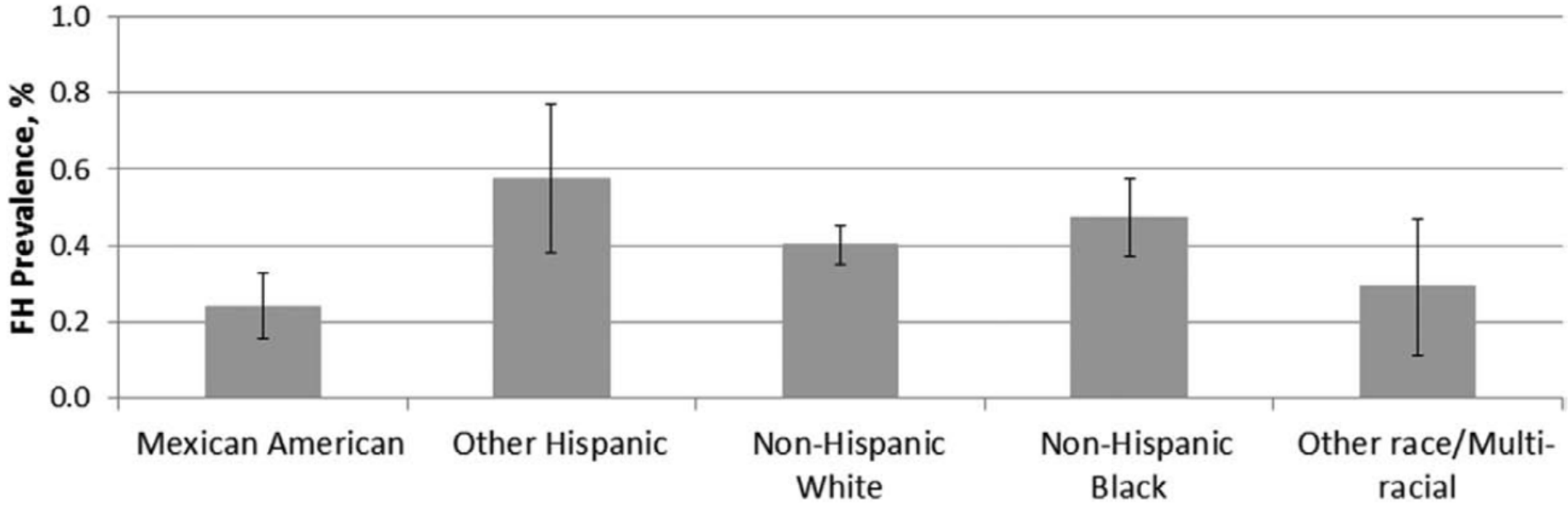
Survey

RESEARCH USING NHANES: PREVALENCE

Study Design Strength: Nationally Representative

Ex: Familial Hypercholesterolemia

1 in 250 US adults



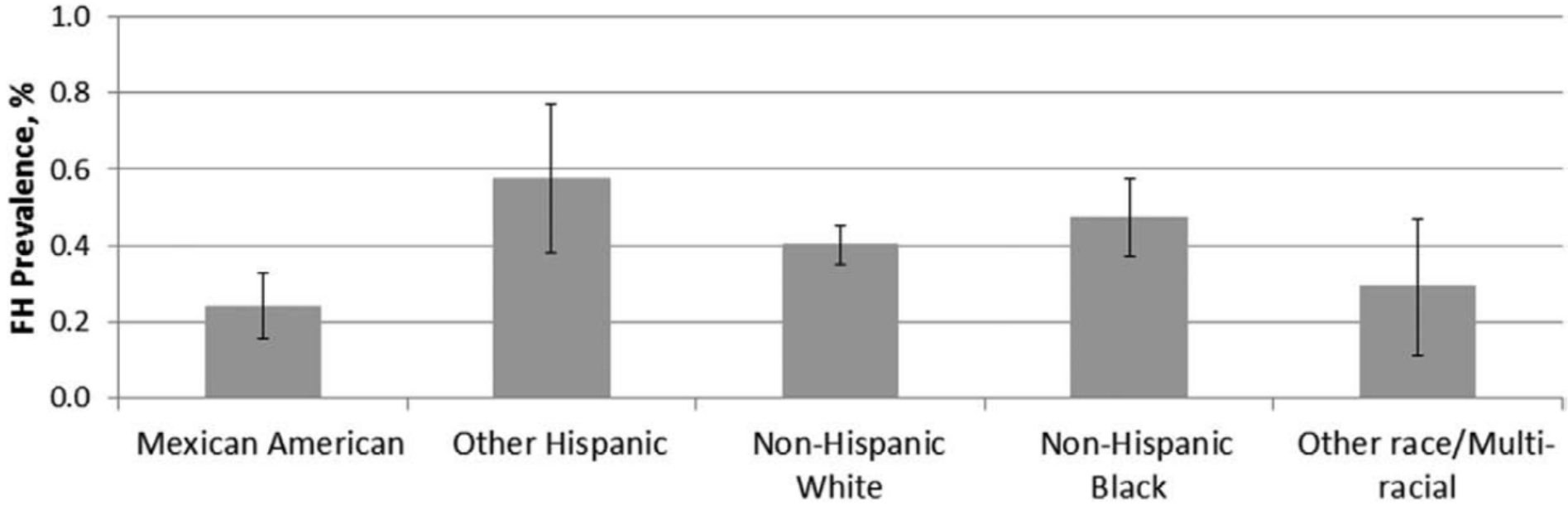
de Ferranti et al (2016) *Circulation* 133:1067-1072. DOI: 10.1161/CIRCULATIONAHA.115.018791

RESEARCH USING NHANES: PREVALENCE

Study Design Weakness: Sample Size

Ex: Familial Hypercholesterolemia using NHANES 1999 - 2012

1 in 250 US adults



de Ferranti et al (2016) *Circulation* 133:1067-1072. DOI: 10.1161/CIRCULATIONAHA.115.018791

RESEARCH USING NHANES: PREVALENCE

Study Design Weakness: Limited to Variables Collected

Ex: Familial Hypercholesterolemia using NHANES 1999 - 2012

1 in 250 US adults with probable or definite FH using Dutch Lipid Clinics criteria

✓ Fasting, sans treatment LDL-C*

✓ Hx of premature CAD, stroke, peripheral vascular disease

✓ Family Hx of premature CAD, stroke, peripheral vascular disease

X Physical exam specific to FH

X FH genetic testing results

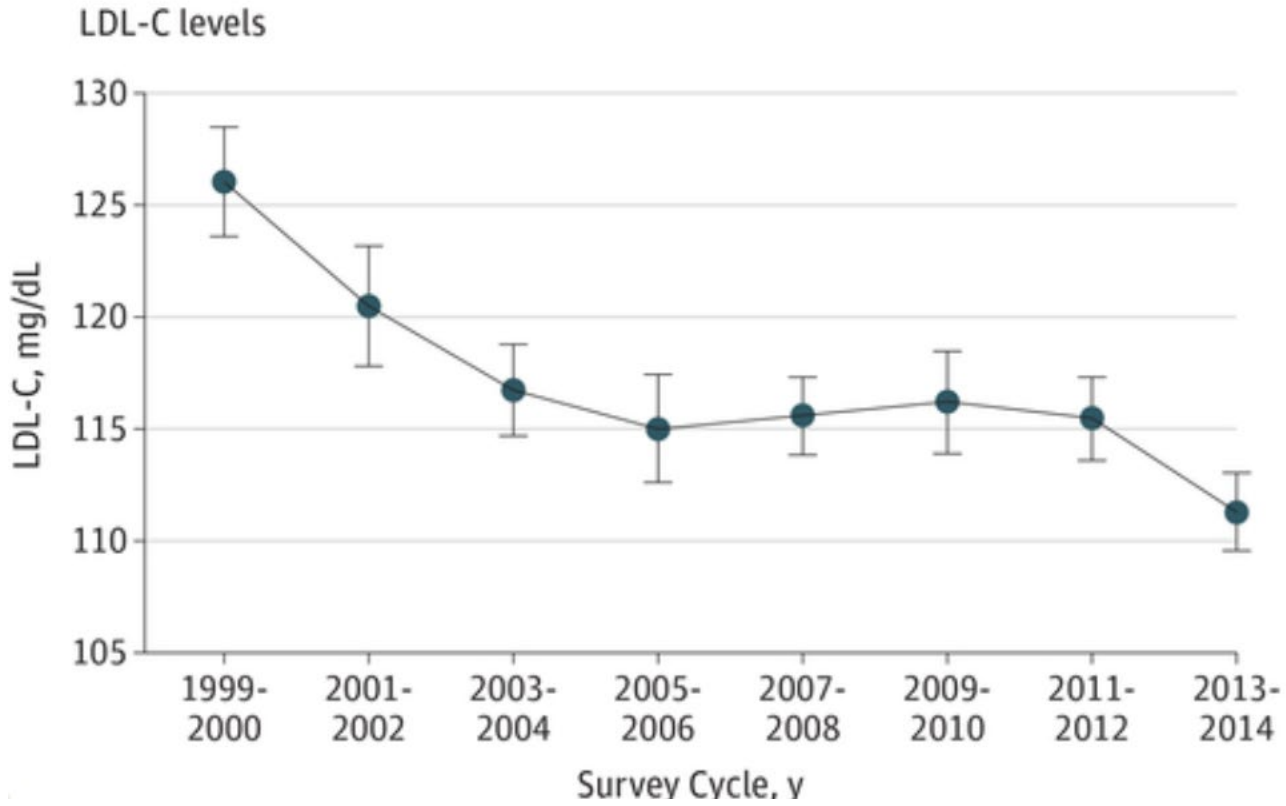
de Ferranti et al (2016) *Circulation* 133:1067-1072. doi: 10.1161/CIRCULATIONAHA.115.018791

RESEARCH USING NHANES: TRENDS

Study Design Strength: Conducted Yearly (Continuous)

Ex. Trends in LDL-C levels

Age-adjusted trends in 17,096 adults shows decline in LDL-C over time



Rosinger et al (2017) *JAMA Cardiol* 2(3):339-341. doi: 10.1001/jamacardio.2016.4396

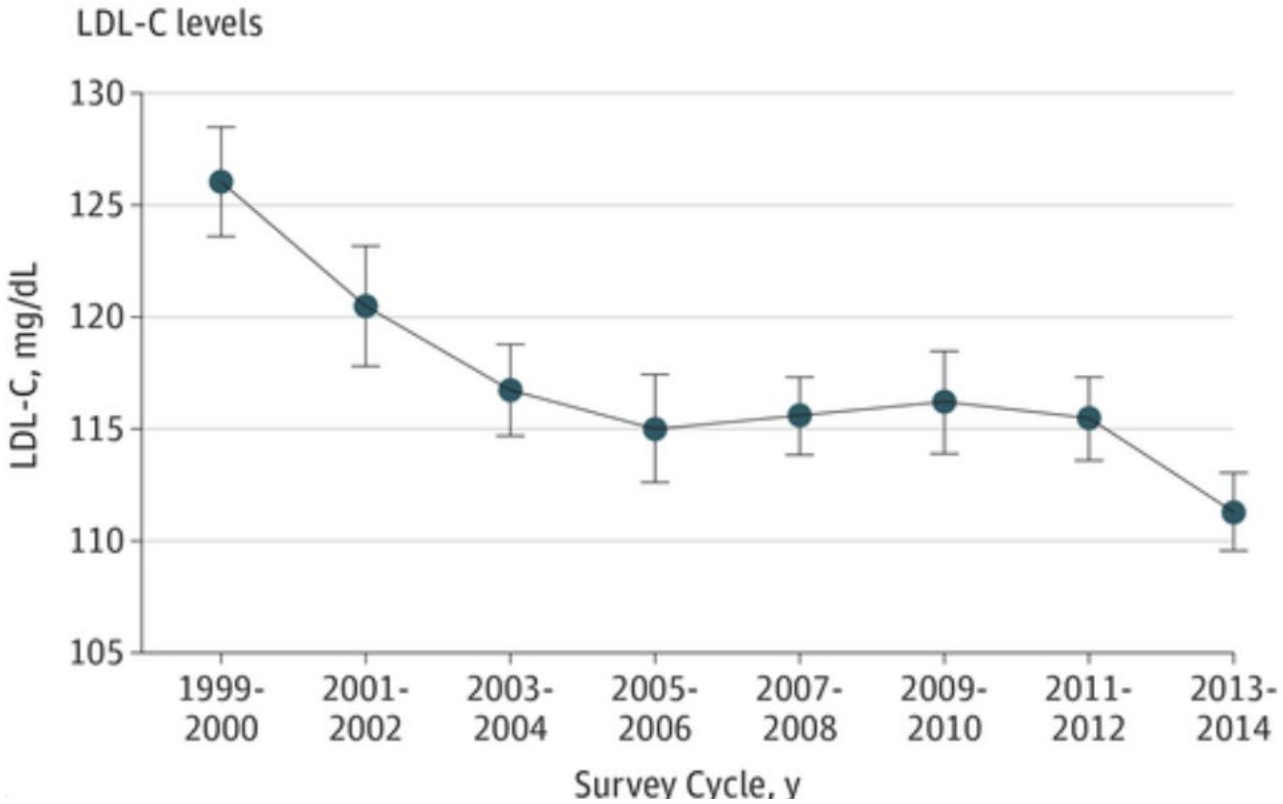
RESEARCH USING NHANES: TRENDS

Study Design Weakness: Limited to hypothesis generating

Ex. Trends in LDL-C levels

Age-adjusted trends in 17,096 adults shows decline in LDL-C over time

Reductions in LDL-C due to…?



Rosinger et al (2017) *JAMA Cardiol* 2(3):339-341. doi: 10.1001/jamacardio.2016.4396

RESEARCH USING NHANES: TRENDS

Study Design Weakness: Cross-sectional

Ex. Trends in LDL-C levels

Table 1. Characteristics of Fasting Non-Hispanic Whites Aged 20 Years or Older[a]

	NHANES Year of Specimen Collection	
	2000 (n = 229)	2009 (n = 292)
Proportion of males, % (SE)	47.2 (2.7)	47.1 (2.7)
Weighted age, median (range), y[b]	45 (20-80)	46 (20-80)
Body mass index, median (interquartile range)[c]	26.4 (22.4-30.9)	27.5 (23.9-31.6)
Cholesterol, mean (SE), mg/dL		
Low-density lipoprotein[d]	128.2 (2.7)	119.2 (2.3)
High-density lipoprotein[e]	49.6 (1.7)	55.8 (2.1)
Triglycerides, geometric mean (SE), mg/dL[f]	131.1 (5.2)	109.3 (5.8)

		From NHANES 2000 to 2009	
		Difference in Geometric Mean (95% CI), µmol/L	Decrease, %
Vaccenic acid	229	24.3 (19.6-29.0)	56
Elaidic acid	229	24.2 (19.1-29.3)[b]	63
Palmitelaidic acid	229	3.9 (3.2-4.6)	49
Linoelaidic acid	227	1.3 (1.0-1.6)	49
Sum of *trans* -fatty acids	229	54.1 (43.4-64.7)	58

Vesper et al (2012) *JAMA* 307(6):562-563. doi:10.1001/jama.2012.112

RESEARCH USING NHANES: TRENDS

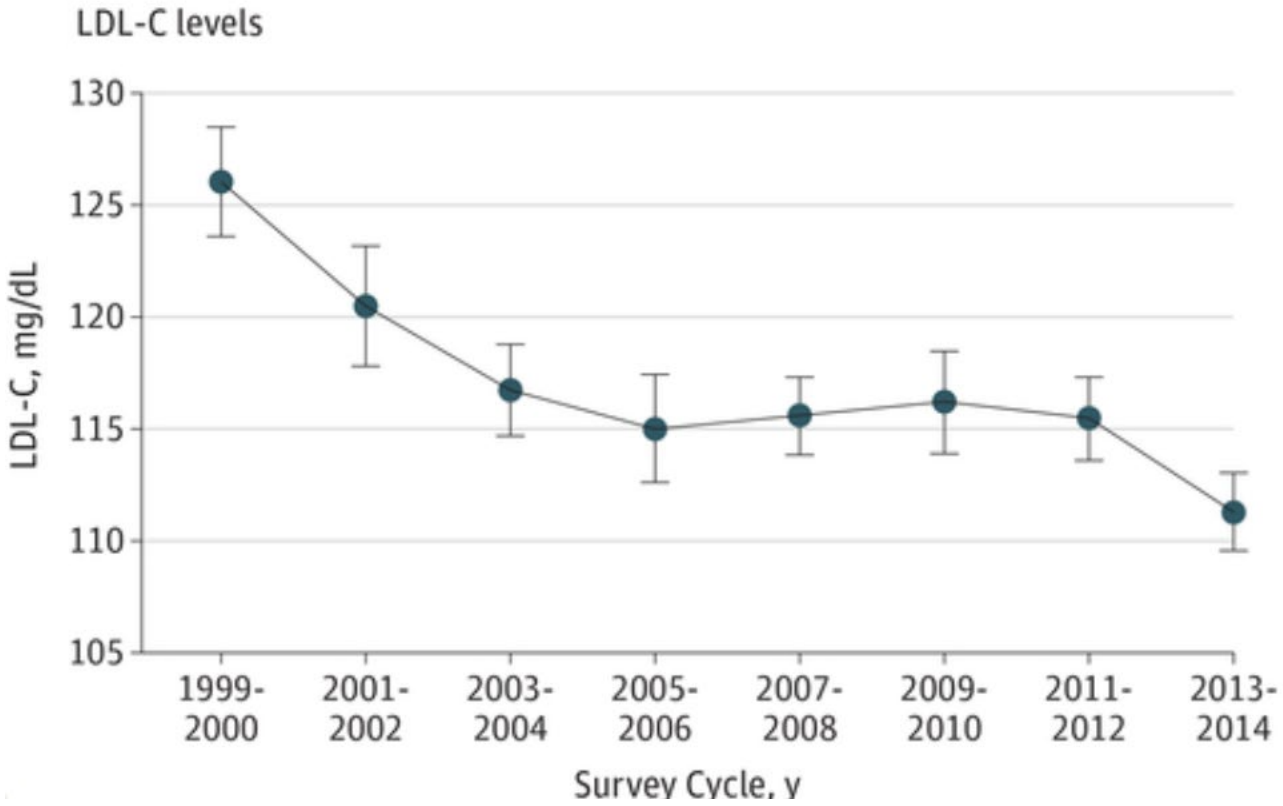
Study Design Weakness: Cross-sectional

Ex. Trends in LDL-C levels

Age-adjusted trends in 17,096 adults shows decline in LDL-C over time

Reductions in LDL-C due to…?

Lower LDL-C leads to…better health? Reduced deaths?



Rosinger et al (2017) *JAMA Cardiol* 2(3):339-341. doi: 10.1001/jamacardio.2016.4396

RESEARCH USING NHANES: TRENDS

Study Design Weakness: Cross-sectional

Link NHANES III death certificate data from NDI

n=4,458 deaths in 23.2 years since NHANES III

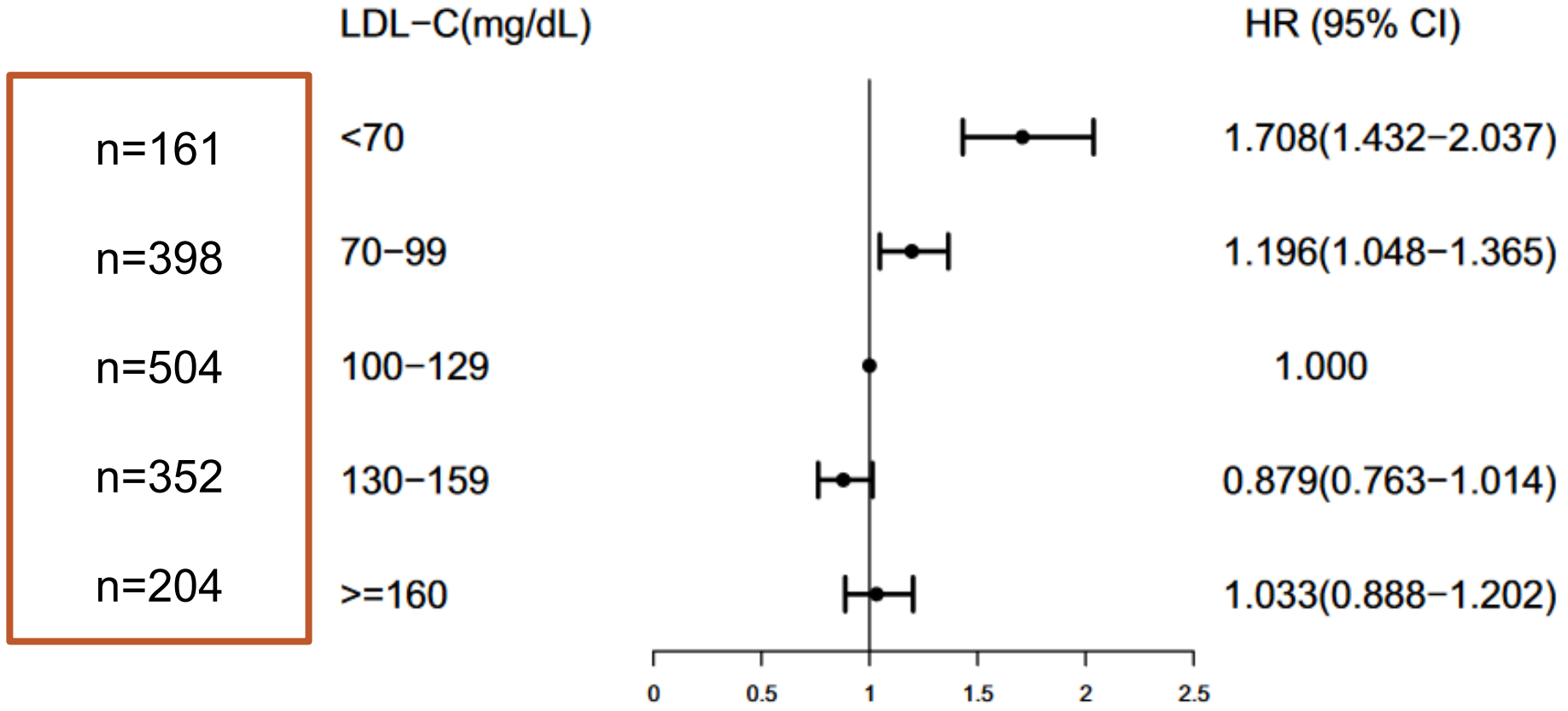
	LDL-C levels					
	<70 mg/dL	70–99.9 mg/dL	100–129.9 mg/dL	130–159.9 mg/dL	160–189.9 mg/dL	≥190 mg/dL
All-cause mortality						
Deaths/ person-years	191/17217	692/68895	1238/98192	1236/71276	681/33030	620/15415
Model 1	1.72 (1.27–2.32)*	1.05 (0.88–1.25)	1 (ref)	0.92 (0.83–1.02)	0.88 (0.76–1.02)	1.07 (0.89–1.27)
Model 2	1.52 (1.14–2.02)*	1.02 (0.86–1.21)	1 (ref)	0.93 (0.84–1.02)	0.86 (0.75–0.99)*	1.05 (0.87–1.27)
Model 3	1.52 (1.14–2.03)*	1.02 (0.86–1.22)	1 (ref)	0.92 (0.83–1.01)	0.86 (0.75–0.99)*	1.06 (0.88–1.29)
Model 4	1.45 (1.10–1.93)*	1.03 (0.86–1.22)	1 (ref)	0.92 (0.83–1.02)	0.88 (0.76–1.01)	1.08 (0.88–1.32)
CVD mortality						
Deaths/ person-years	41/17217	166/68895	317/98192	350/71276	236/33030	133/15415
Model 1	1.88 (1.19–2.98)*	1.26 (0.84–1.87)	1 (ref)	1.16 (0.84–1.58)	1.28 (0.97–1.70)	1.44 (1.06–1.98)*
Model 2	1.66 (1.05–2.62)*	1.24 (0.84–1.83)	1 (ref)	1.17 (0.86–1.59)	1.27 (0.97–1.67)	1.43 (1.06–1.93)*
Model 3	1.65 (1.04–2.62)*	1.24 (0.83–1.83)	1 (ref)	1.17 (0.86–1.58)	1.27 (0.96–1.67)	1.45 (1.08–1.95)*
Model 4	1.60 (1.01–2.54)*	1.28 (0.86–1.90)	1 (ref)	1.19 (0.87–1.62)	1.30 (0.98–1.72)	1.49 (1.09–2.02)*

Rong et al (2022) Am J Heart Assoc 11(15):e023690. doi: 10.1161/JAHA.121.023690

RESEARCH USING NHANES: TRENDS

Study Design Weakness: Cross-sectional

Continuous NHANES linked to mortality public use files



Liu et al (2021) Scientific Reports 11:22111 doi.org/10.1038/s41598-021-01738-w

RESEARCH USING NHANES

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

RESEARCH USING NHANES

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	
Fields to Search	All
Sort By	Variable Name
Limited Access	Exclude
Release Cycle	All
Seach Result Page Size	50

Search

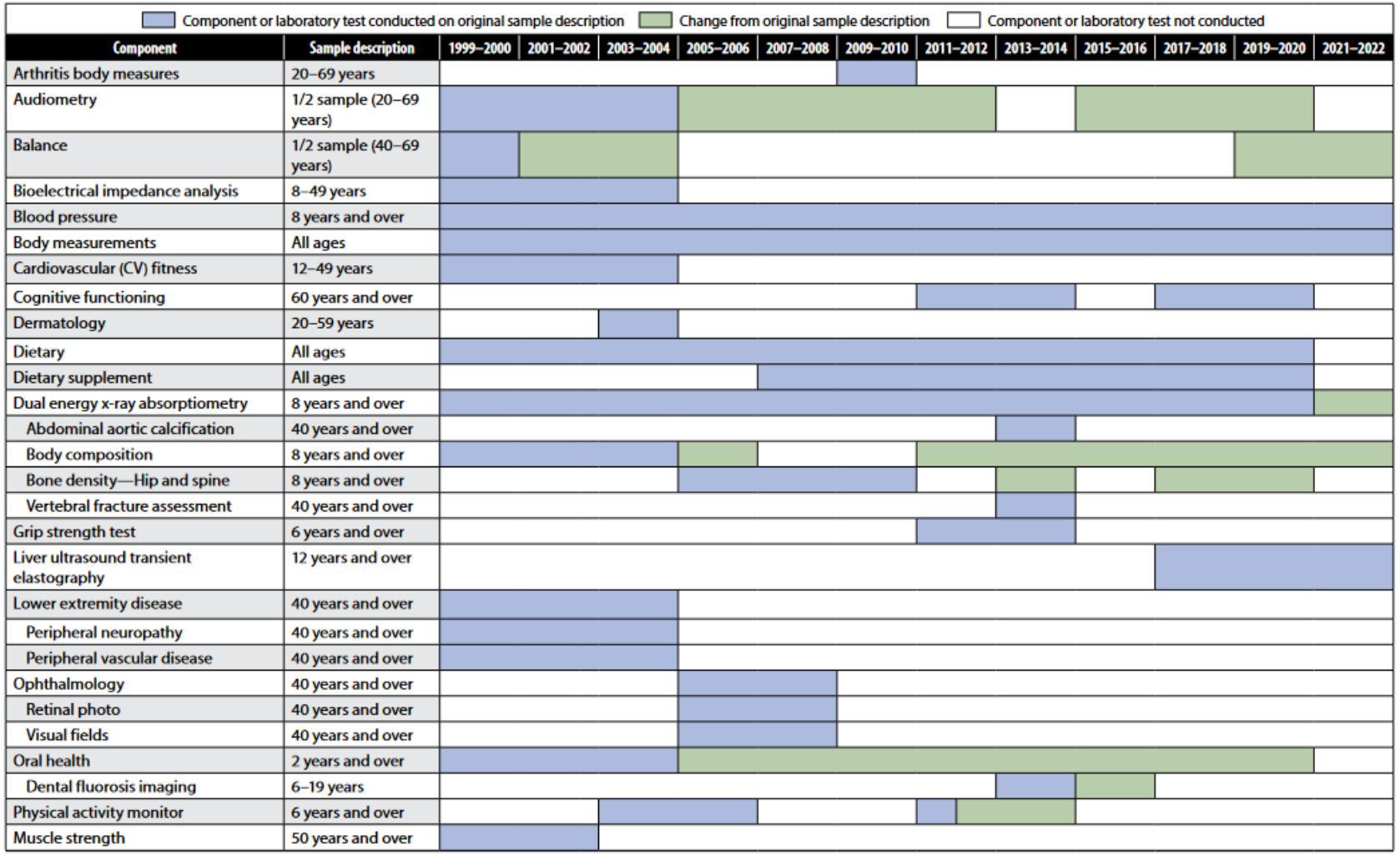
Full content of Continuous NHANES

- Survey Content Brochure [PDF – 568 KB]

RESEARCH USING NHANES

What's New

Table 3. Examination components: National Health and Nutrition Examination Survey, 1999–2022



Component or laboratory test conducted on original sample description | Change from original sample description | Component or laboratory test not conducted

Component	Sample description	1999–2000	2001–2002	2003–2004	2005–2006	2007–2008	2009–2010	2011–2012	2013–2014	2015–2016	2017–2018	2019–2020	2021–2022
Arthritis body measures	20–69 years												
Audiometry	1/2 sample (20–69 years)												
Balance	1/2 sample (40–69 years)												
Bioelectrical impedance analysis	8–49 years												
Blood pressure	8 years and over												
Body measurements	All ages												
Cardiovascular (CV) fitness	12–49 years												
Cognitive functioning	60 years and over												
Dermatology	20–59 years												
Dietary	All ages												
Dietary supplement	All ages												
Dual energy x-ray absorptiometry	8 years and over												
Abdominal aortic calcification	40 years and over												
Body composition	8 years and over												
Bone density—Hip and spine	8 years and over												
Vertebral fracture assessment	40 years and over												
Grip strength test	6 years and over												
Liver ultrasound transient elastography	12 years and over												
Lower extremity disease	40 years and over												
Peripheral neuropathy	40 years and over												
Peripheral vascular disease	40 years and over												
Ophthalmology	40 years and over												
Retinal photo	40 years and over												
Visual fields	40 years and over												
Oral health	2 years and over												
Dental fluorosis imaging	6–19 years												
Physical activity monitor	6 years and over												
Muscle strength	50 years and over												

RESEARCH USING NHANES 2024

- Still in planning phase
- Variables collected to be determined
- Faster, nimbler than previous NHANES
  - One-year cycle instead of two
  - Mobile exam units instead of trailers

NHANES:

TYPES OF RESEARCH SUPPORTED BY THE CURRENT SURVEY DATA

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CLEVELAND INSTITUTE FOR COMPUTATIONAL BIOLOGY

National

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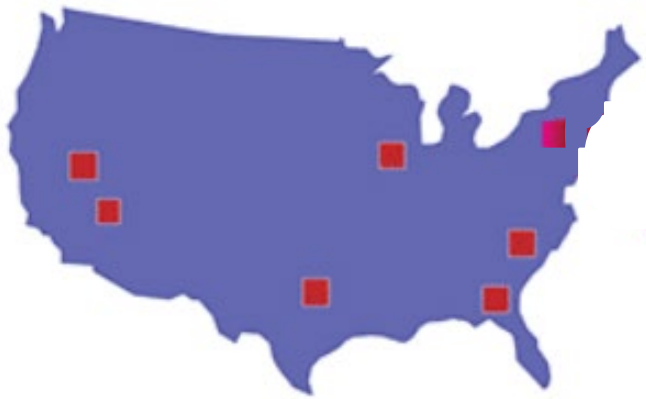

Participants are

- Civilian
- Non-institutionalized
- US residents

National

H

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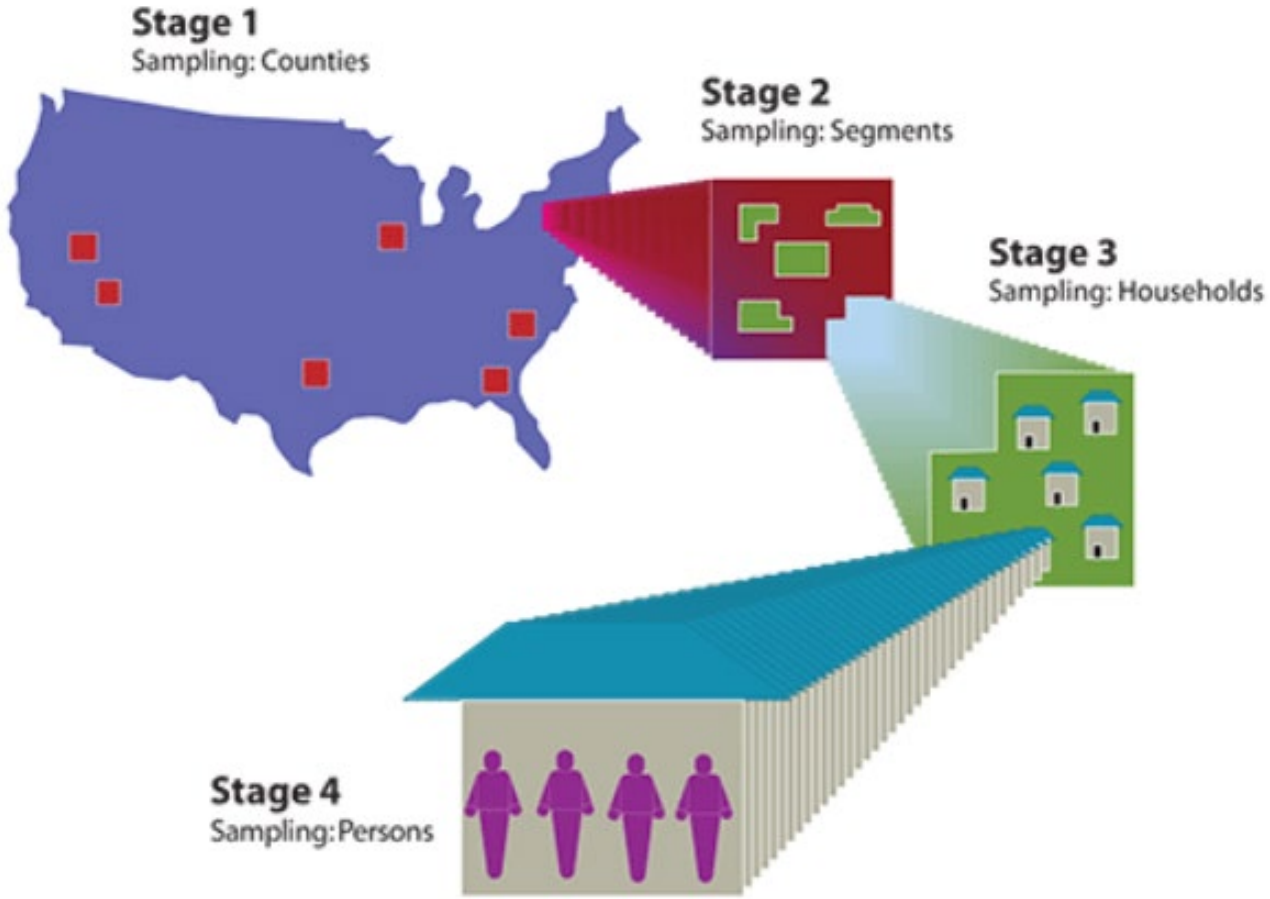

Sampling is

- Not random
- Not convenient
- Complex, multistage, probability sampling design

http://medbox.iiab.me/modules/en-cdc/www.cdc.gov/nchs/nhanes/participant.htm

National

Health

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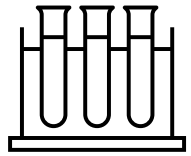


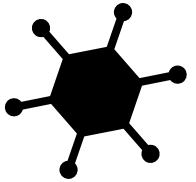
Standard biochemistry panel; CBC

Height, weight, body mass index, obesity

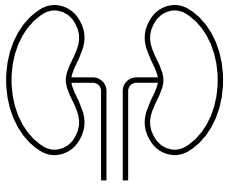
Physical activity

Immunizations

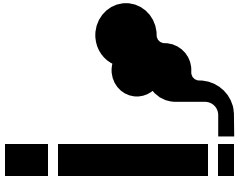
STIs



Kidney conditions

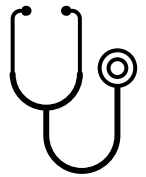


Cardiovascular health and cholesterol

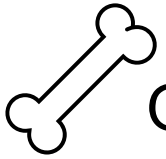


Smoking and tobacco use

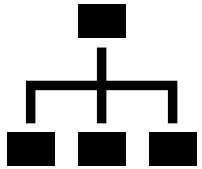
Blood pressure



Lead, mercury, toxins



Osteoporosis (DEXA)



Diabetes

https://wwwn.cdc.gov/nchs/data/nhanes/survey_contents.pdf

National

Health

And

Nutrition

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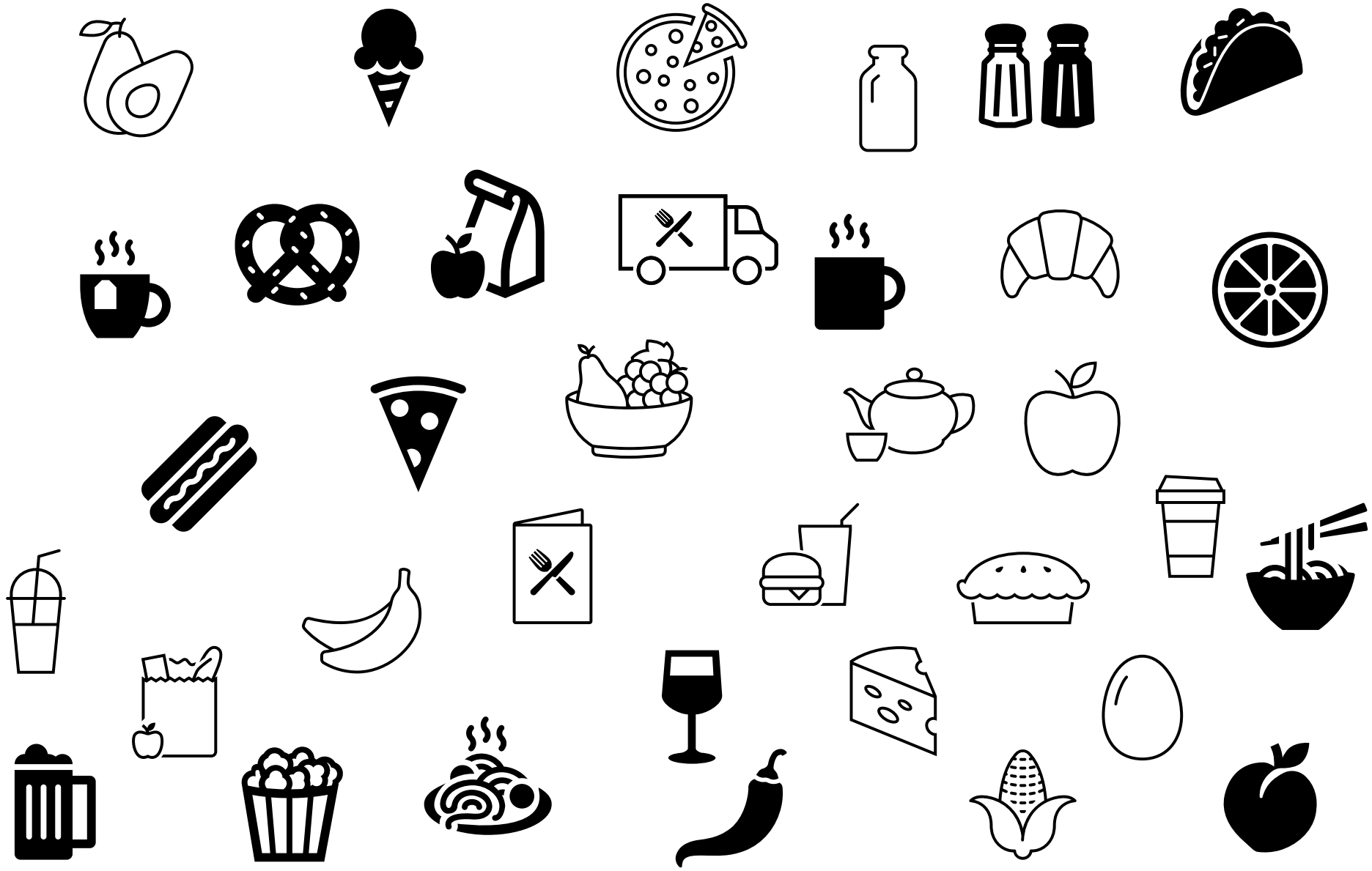

National

Health

And

Nutrition

Examination

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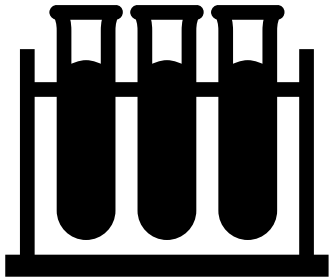
Questionnaires

Labs using biospecimens



Physical exams

National

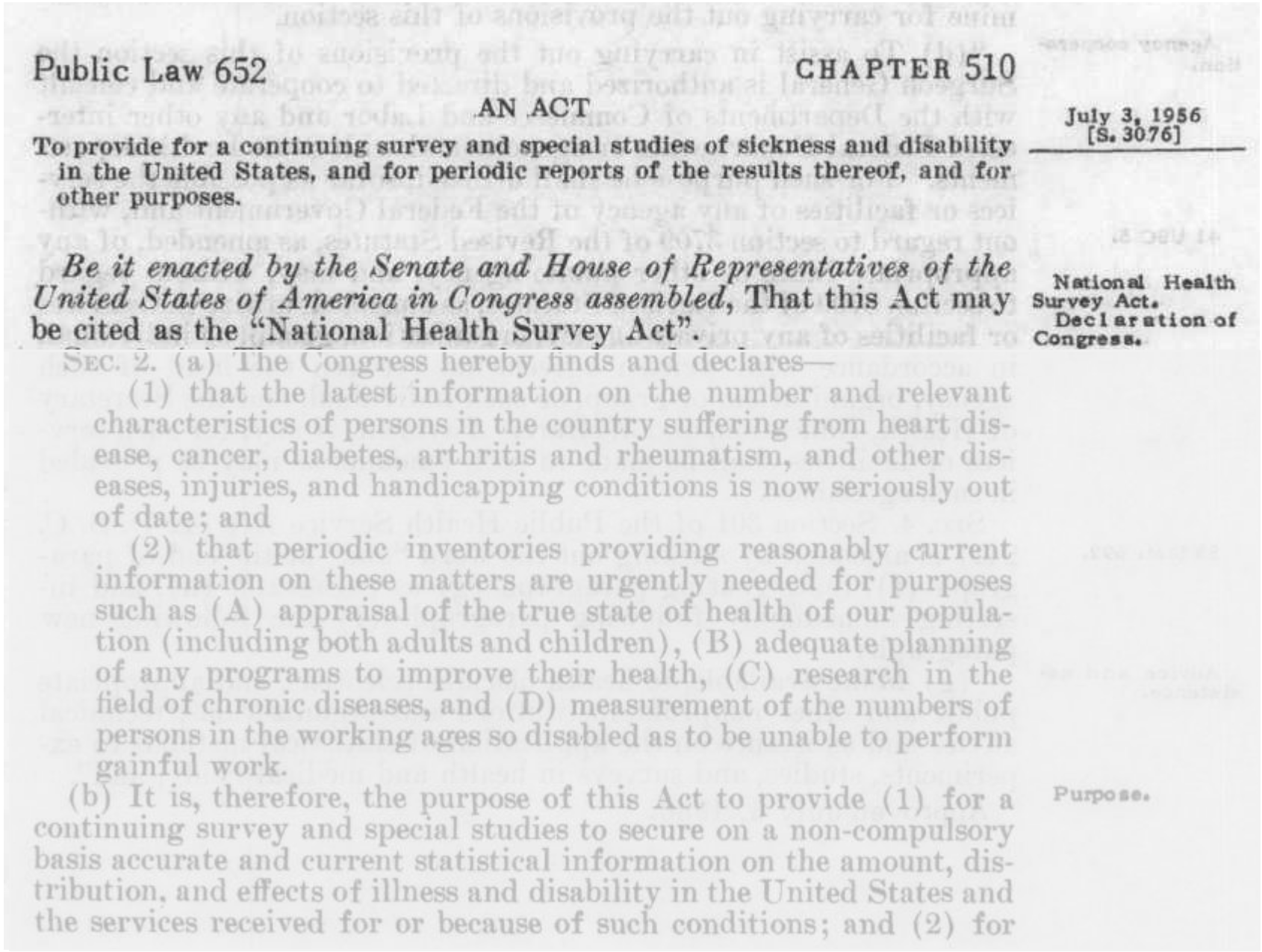
Health

And

Nutrition

Examination

Survey



Public Law 652 CHAPTER 510

AN ACT

July 3, 1956
[S. 3076]

To provide for a continuing survey and special studies of sickness and disability in the United States, and for periodic reports of the results thereof, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Health Survey Act".

National Health Survey Act.

Declaration of Congress.

SEC. 2. (a) The Congress hereby finds and declares—

(1) that the latest information on the number and relevant characteristics of persons in the country suffering from heart disease, cancer, diabetes, arthritis and rheumatism, and other diseases, injuries, and handicapping conditions is now seriously out of date; and

(2) that periodic inventories providing reasonably current information on these matters are urgently needed for purposes such as (A) appraisal of the true state of health of our population (including both adults and children), (B) adequate planning of any programs to improve their health, (C) research in the field of chronic diseases, and (D) measurement of the numbers of persons in the working ages so disabled as to be unable to perform gainful work.

Purpose.

(b) It is, therefore, the purpose of this Act to provide (1) for a continuing survey and special studies to secure on a non-compulsory basis accurate and current statistical information on the amount, distribution, and effects of illness and disability in the United States and the services received for or because of such conditions; and (2) for

https://www.govinfo.gov/content/pkg/STATUTE-70/pdf/STATUTE-70-Pg489-2.pdf#page=1

National

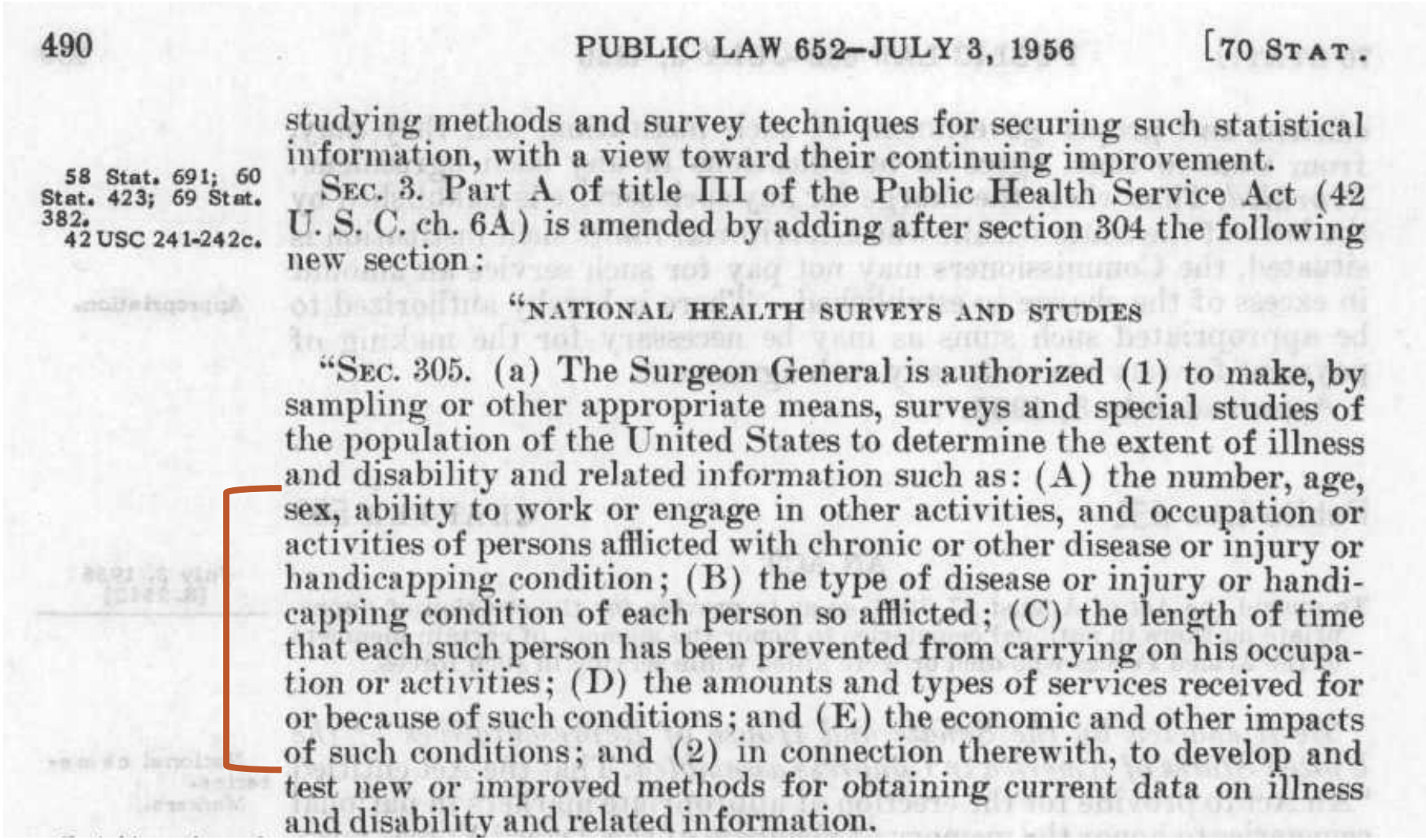
Health

And

Nutrition

Examination

Survey



490 PUBLIC LAW 652—JULY 3, 1956 [70 STAT.

studying methods and survey techniques for securing such statistical information, with a view toward their continuing improvement.

58 Stat. 691; 60 Stat. 423; 69 Stat. 382. 42 USC 241-242c.

SEC. 3. Part A of title III of the Public Health Service Act (42 U. S. C. ch. 6A) is amended by adding after section 304 the following new section:

"NATIONAL HEALTH SURVEYS AND STUDIES

"SEC. 305. (a) The Surgeon General is authorized (1) to make, by sampling or other appropriate means, surveys and special studies of the population of the United States to determine the extent of illness and disability and related information such as: (A) the number, age, sex, ability to work or engage in other activities, and occupation or activities of persons afflicted with chronic or other disease or injury or handicapping condition; (B) the type of disease or injury or handicapping condition of each person so afflicted; (C) the length of time that each such person has been prevented from carrying on his occupation or activities; (D) the amounts and types of services received for or because of such conditions; and (E) the economic and other impacts of such conditions; and (2) in connection therewith, to develop and test new or improved methods for obtaining current data on illness and disability and related information.

https://www.govinfo.gov/content/pkg/STATUTE-70/pdf/STATUTE-70-Pg489-2.pdf#page=1

RESEARCH USING NHANES: ASSOCIATION

Study Design Strength: Dietary variables available

Added sugar and association with dyslipidemia, NHANES 1999-2006

Table 2. Adjusted Odds Ratios of Dyslipidemia Among US Adults (>18 Years) Associated With Consumption of Added Sugar[a]

Dyslipidemia Measure	%Total Energy From Added Sugar				
	<5 (n = 893)	5-<10 (n = 1124)	10-<17.5 (n = 1751)	17.5-<25 (n = 1210)	≥25 (n = 1135)
Low HDL-C (<50 mg/dL [women]; <40 mg/dL [men]) Prevalence, %	22.4	22.6	28.2	31.7	43.9
Adjusted OR (95% CI)					
Model 1[b,c]	1 [Reference]	1.0 (0.7-1.4)	1.3 (1.0-1.7)	1.6 (1.2-2.0)	2.6 (2.0-3.4)
Model 2[c,d]	1 [Reference]	1.0 (0.8-1.4)	1.5 (1.2-1.9)	1.9 (1.5-2.6)	3.1 (2.3-4.3)
High triglycerides (>150 mg/dL) Prevalence, %	26.4	22.9	27.0	28.7	28.0
Adjusted OR (95% CI)					
Model 1[b,e]	1 [Reference]	0.8 (0.7-1.1)	1.1 (0.9-1.3)	1.2 (0.9-1.4)	1.3 (1.0-1.7)
Model 2[d,e]	1 [Reference]	0.8 (0.7-1.1)	1.1 (0.9-1.4)	1.3 (1.0-1.6)	1.2 (0.9-1.6)
High LDL-C (>130 mg/dL) Prevalence, %	37.3	35.1	36.9	37.0	35.5
Adjusted OR (95% CI)					
Model 1[b]	1 [Reference]	0.9 (0.7-1.2)	1.0 (0.8-1.3)	1.1 (0.8-1.3)	1.1 (0.9-1.5)
Model 2[d]	1 [Reference]	0.9 (0.7-1.2)	1.1 (0.9-1.3)	1.1 (0.9-1.5)	1.2 (0.9-1.7)
High triglycerides–HDL-C ratio (>3.8) Prevalence, %	19.9	15.3	19.7	23.4	24.9
Adjusted OR (95% CI)					
Model 1[b,c]	1 [Reference]	0.7 (0.5-1.0)	1.0 (0.8-1.3)	1.2 (0.9-1.6)	1.5 (1.1-2.0)
Model 2[c,d]	1 [Reference]	0.7 (0.5-1.0)	1.1 (0.8-1.4)	1.5 (1.1-2.0)	1.6 (1.1-2.3)

Welsh et al (2010) *JAMA* 303(15):1490-1497. doi:10.1001/jama.2010.449

RESEARCH USING NHANES: ASSOCIATION

Study Design Weakness: Cross-sectional

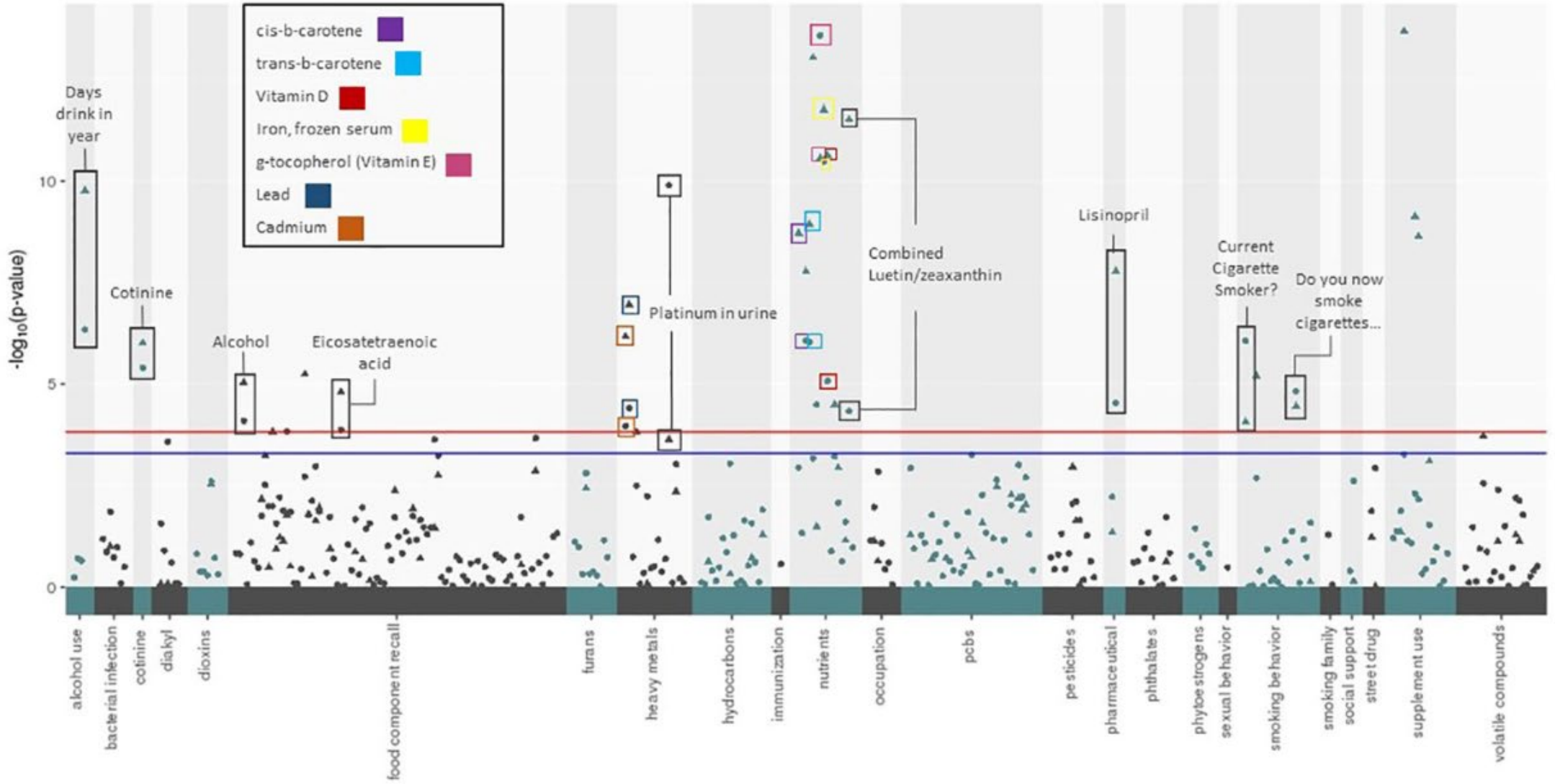
Added sugar and association with dyslipidemia, NHANES 1999-2006

Table 2. Adjusted Odds Ratios of Dyslipidemia Among US Adults (>18 Years) Associated With Consumption of Added Sugar[a]

Dyslipidemia Measure	%Total Energy From Added Sugar				
	<5 (n = 893)	5-<10 (n = 1124)	10-<17.5 (n = 1751)	17.5-<25 (n = 1210)	≥25 (n = 1135)
Low HDL-C (<50 mg/dL [women]; <40 mg/dL [men]) Prevalence, %	22.4	22.6	28.2	31.7	43.9
Adjusted OR (95% CI) Model 1[b,c]	1 [Reference]	1.0 (0.7-1.4)	1.3 (1.0-1.7)	1.6 (1.2-2.0)	2.6 (2.0-3.4)
Model 2[c,d]	1 [Reference]	1.0 (0.8-1.4)	1.5 (1.2-1.9)	1.9 (1.5-2.6)	3.1 (2.3-4.3)
High triglycerides (>150 mg/dL) Prevalence, %	26.4	22.9	27.0	28.7	28.0
Adjusted OR (95% CI) Model 1[b,e]	1 [Reference]	0.8 (0.7-1.1)	1.1 (0.9-1.3)	1.2 (0.9-1.4)	1.3 (1.0-1.7)
Model 2[d,e]	1 [Reference]	0.8 (0.7-1.1)	1.1 (0.9-1.4)	1.3 (1.0-1.6)	1.2 (0.9-1.6)
High LDL-C (>130 mg/dL) Prevalence, %	37.3	35.1	36.9	37.0	35.5
Adjusted OR (95% CI) Model 1[b]	1 [Reference]	0.9 (0.7-1.2)	1.0 (0.8-1.3)	1.1 (0.8-1.3)	1.1 (0.9-1.5)
Model 2[d]	1 [Reference]	0.9 (0.7-1.2)	1.1 (0.9-1.3)	1.1 (0.9-1.5)	1.2 (0.9-1.7)
High triglycerides–HDL-C ratio (>3.8) Prevalence, %	19.9	15.3	19.7	23.4	24.9
Adjusted OR (95% CI) Model 1[b,c]	1 [Reference]	0.7 (0.5-1.0)	1.0 (0.8-1.3)	1.2 (0.9-1.6)	1.5 (1.1-2.0)
Model 2[c,d]	1 [Reference]	0.7 (0.5-1.0)	1.1 (0.8-1.4)	1.5 (1.1-2.0)	1.6 (1.1-2.3)

Welsh et al (2010) *JAMA* 303(15):1490-1497. doi:10.1001/jama.2010.449

RESEARCH USING NHANES: DATA MINING



Lucas et al (2019) *Frontiers in Genetics* 10:1240. doi: 10.3389/fgene.2019.01240