Non-Response Bias in the National Health and Nutrition Examination Surveys

A Comparison of Cooperative Participants versus Late, Inaccessible, or Reluctant Participants

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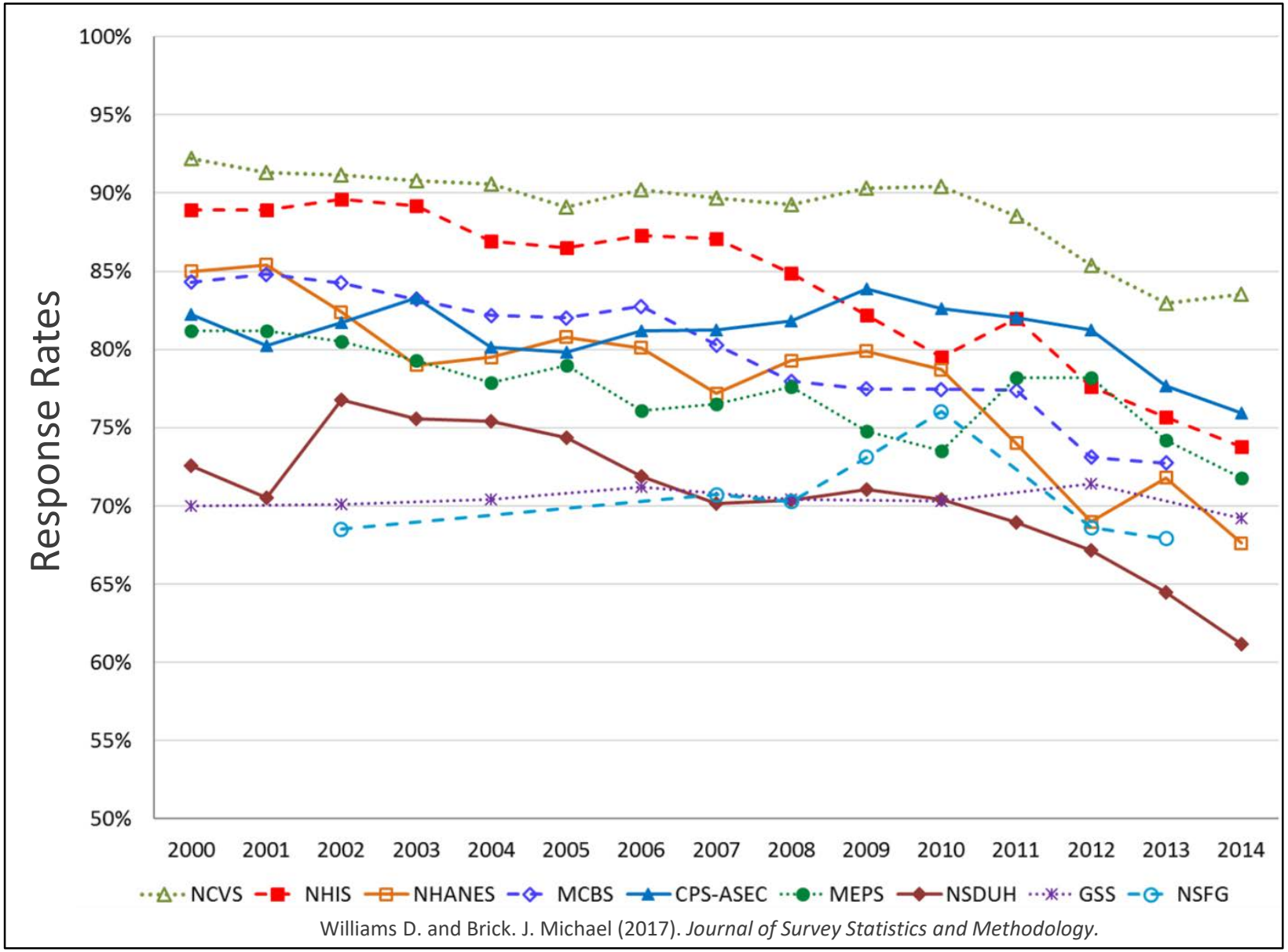
Trends in US Face-to-Face Household Surveys: 2000 to 2014

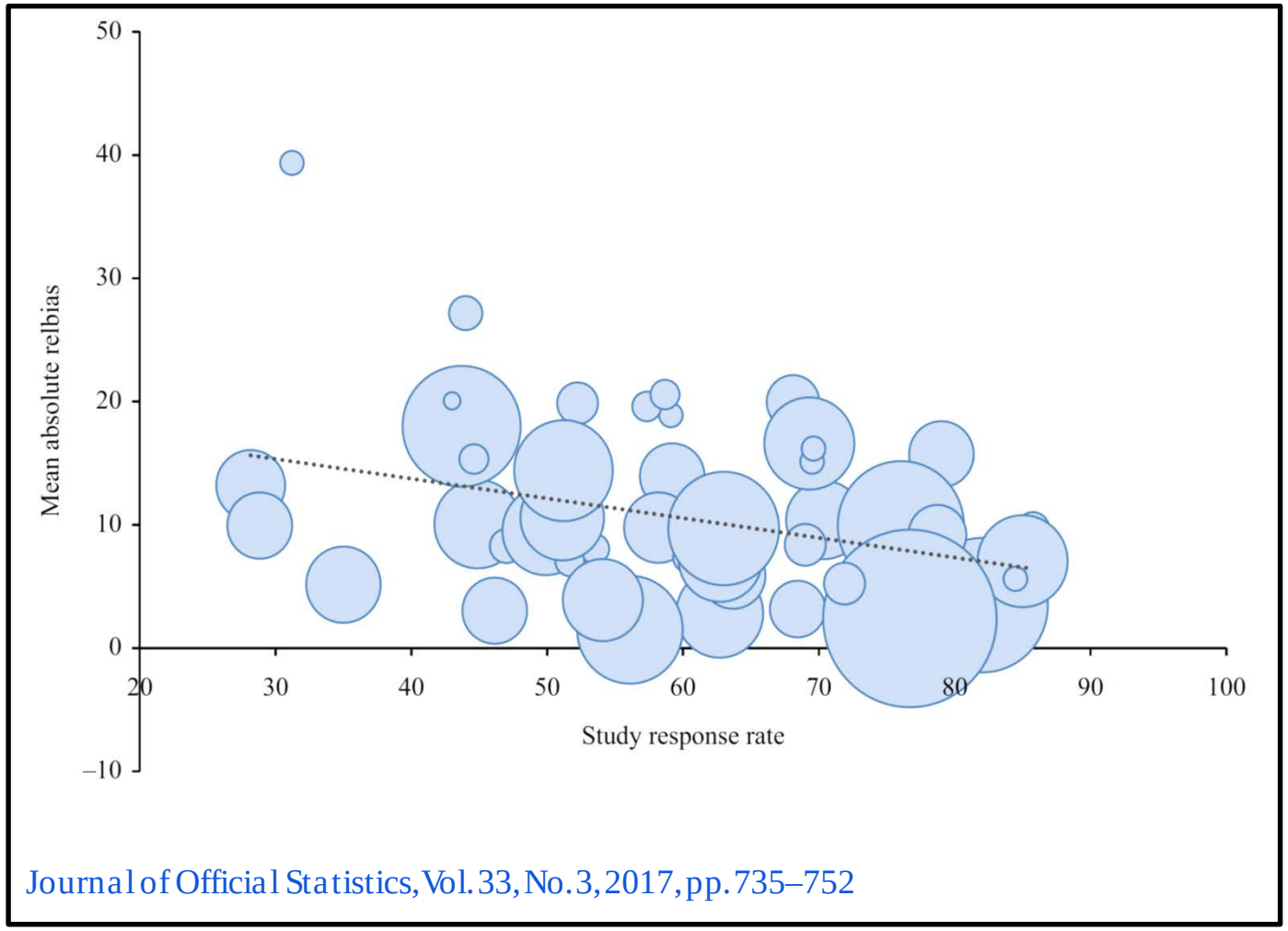
- Response rates (RR) declined since 2000
- Driven by changes to the survey landscape
  - Political, physical, and communication
- Relationship between nonresponse and bias is complex
  - No known RR cutoff



Williams D. and Brick. J. Michael (2017). *Journal of Survey Statistics and Methodology.*

Relationship between Nonresponse and Bias is Complex

- Increasing RR can help reduce the nonresponse bias on average across estimates within a study
- Image: relationship between mean absolute relative bias and RRs for 59 studies and 959 estimates



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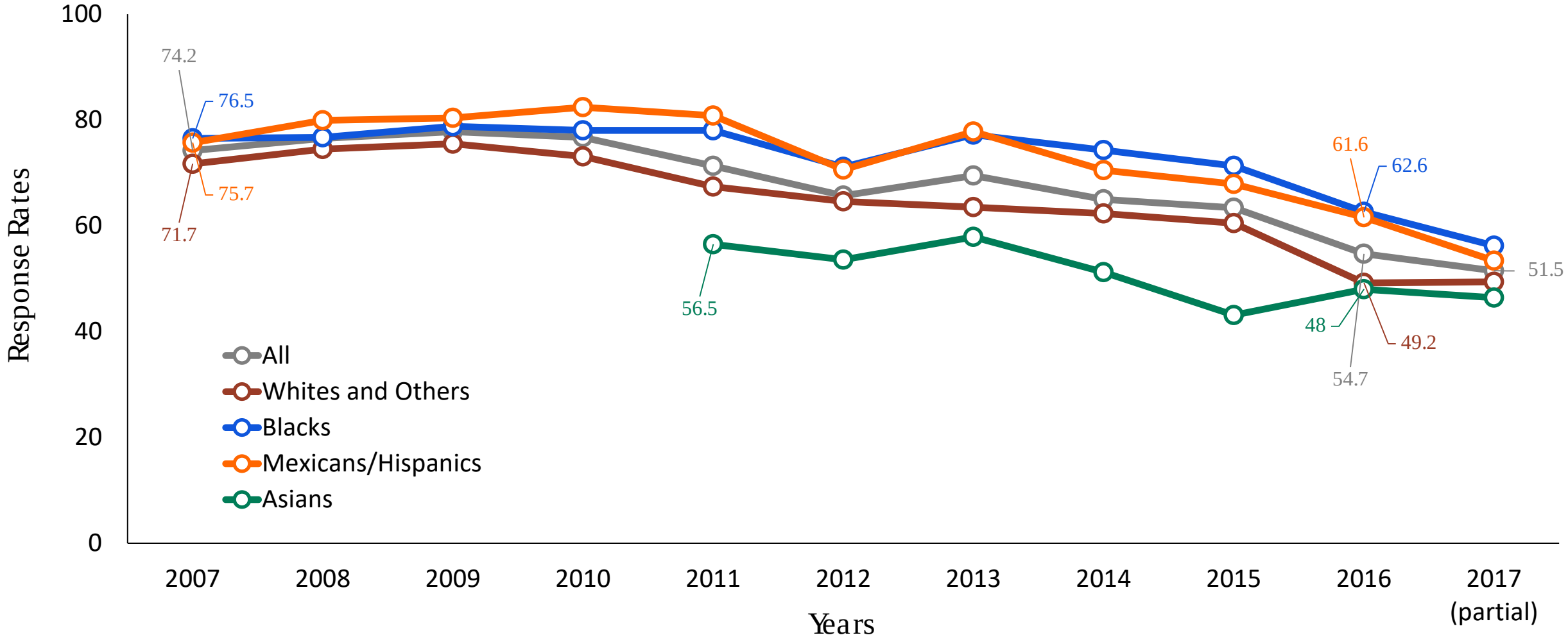
Trends in Response Rates by Race and Hispanic Origin
NHANES 2007 to 2017



Approaches to Assess Nonresponse Bias (*Groves* 2006)

Five approaches:

1. RR comparisons across subgroups
2. Using sampling frame data or supplemental matched data
3. Comparisons to similar estimates from other sources
4. Contrasting alternative post-survey adjustments for nonresponse
5. Studying variations within existing survey
   - Estimates by quintiles of response propensities
   - “Continuum of resistance” studies

Continuum of Resistance Model

Assumption:

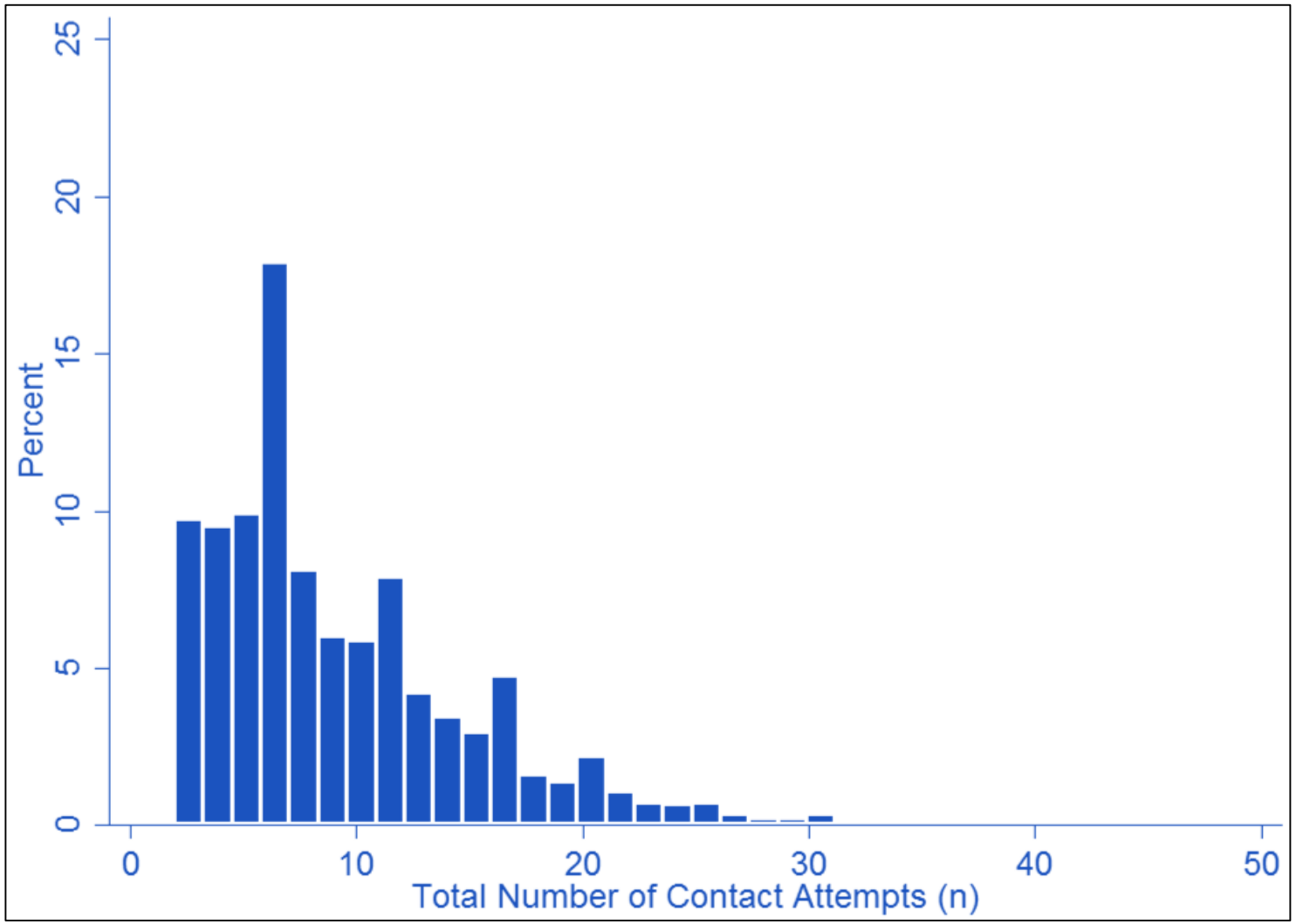
If non-respondents had responded, their survey estimates would be similar to late respondents

Limitation:

No direct information on non-respondents

Number of Contact Attempts: NHANES 2015 – 2016

- Number of attempts to complete the screener and in-home interview
- Range: 2-49 attempts
- Tertiles of contact attempts:
  - 1 – 5 (early respondents)
  - 6 – 9
  - 10+ (late respondents)



Differences in Household (HH) Characteristics by the Number of Contact Attempts: NHANES 2015 – 2016

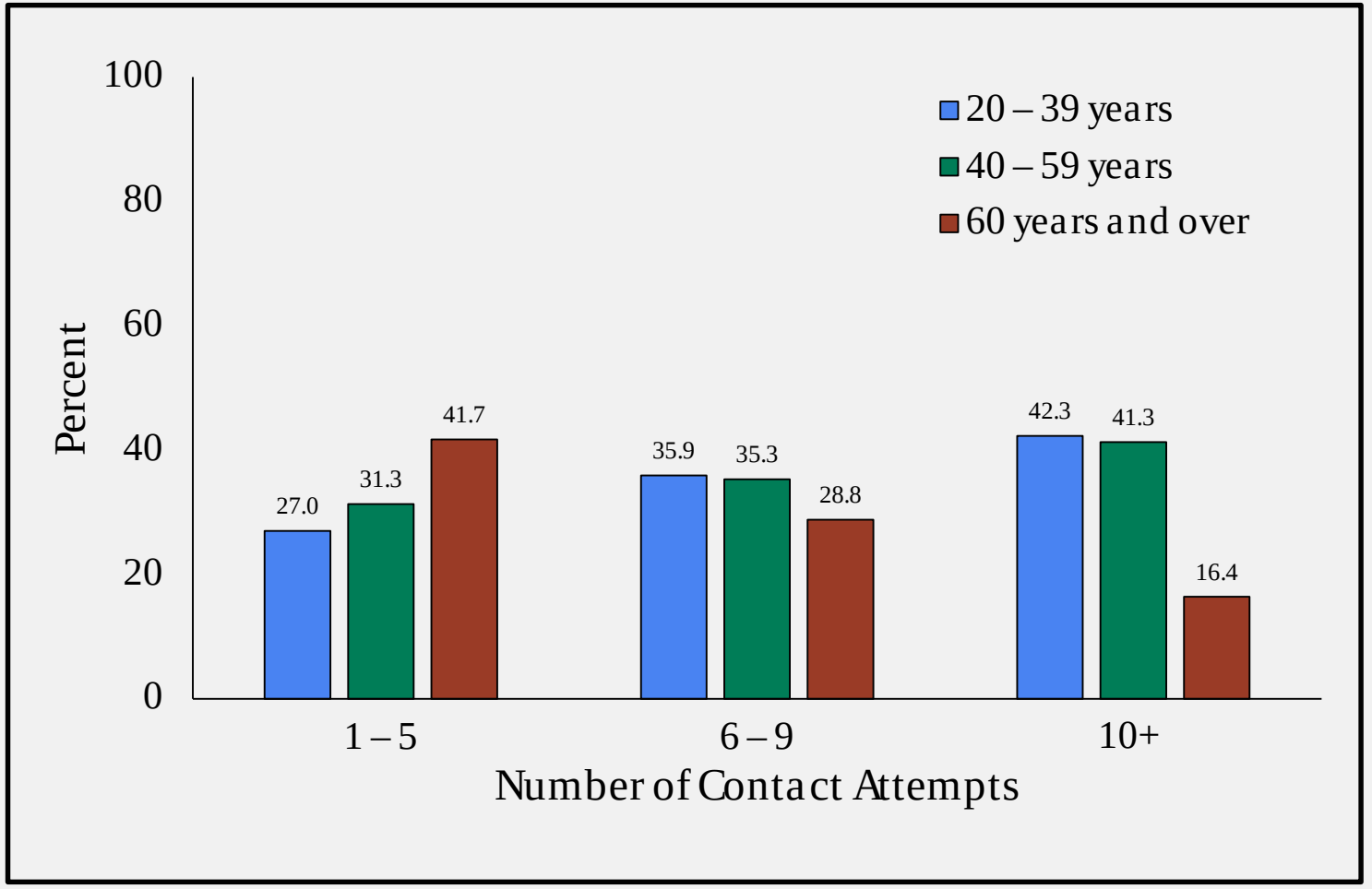
Characteristics	Total	Number of Contact Attempts			*p*-value
		1 – 5	6 – 9	10+	
Number of Sampled Persons (n)	9,950	2,757	3,240	3,953	
HH that Received a Refusal Letter (%)	5.9%	2.5%	5.4%	10.1%	<.0001
HH with Children (%)	50.1%	43.5%	51.0%	56.5%	<.0001
HH that Needed an Interpreter (%)	15.2%	10.6%	14.3%	21.2%	<.0001
HH with Spanish Language Requirement (%)	13.3%	10.0%	11.5%	18.6%	<.0001

Differences in Demographics between Early *vs* Late Respondents

Demographic Differences among Adults by the Number of Contact Attempts: NHANES 2015 – 2016

By Age:

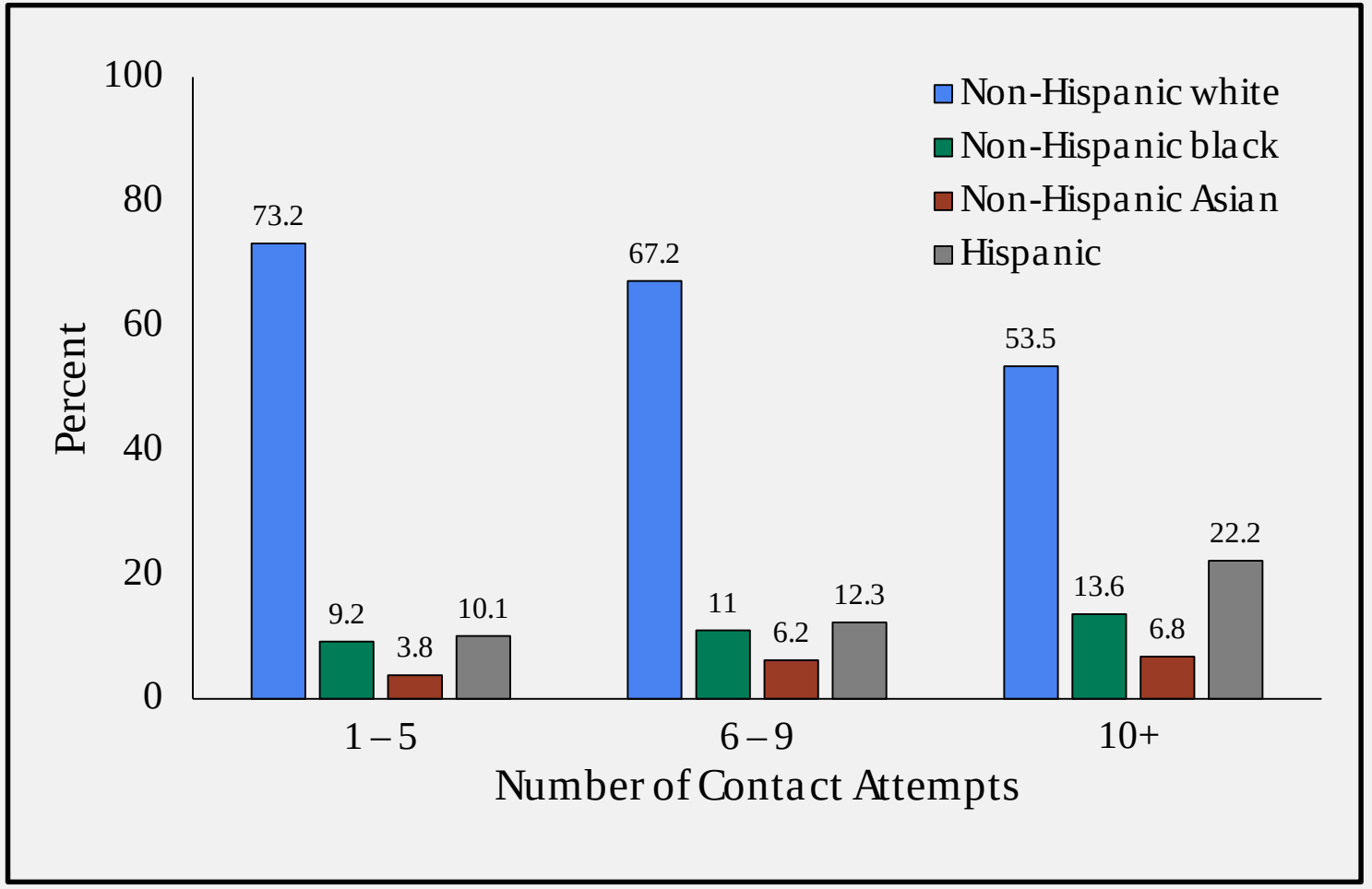
- Different distribution among early vs late respondents (*p<0.05*)
- Among late respondents, 42% were 20-39 years vs 16% were 60+ years.



Demographic Differences among Adults by the Number of Contact Attempts: NHANES 2015 – 2016

By Race and Hispanic Origin:

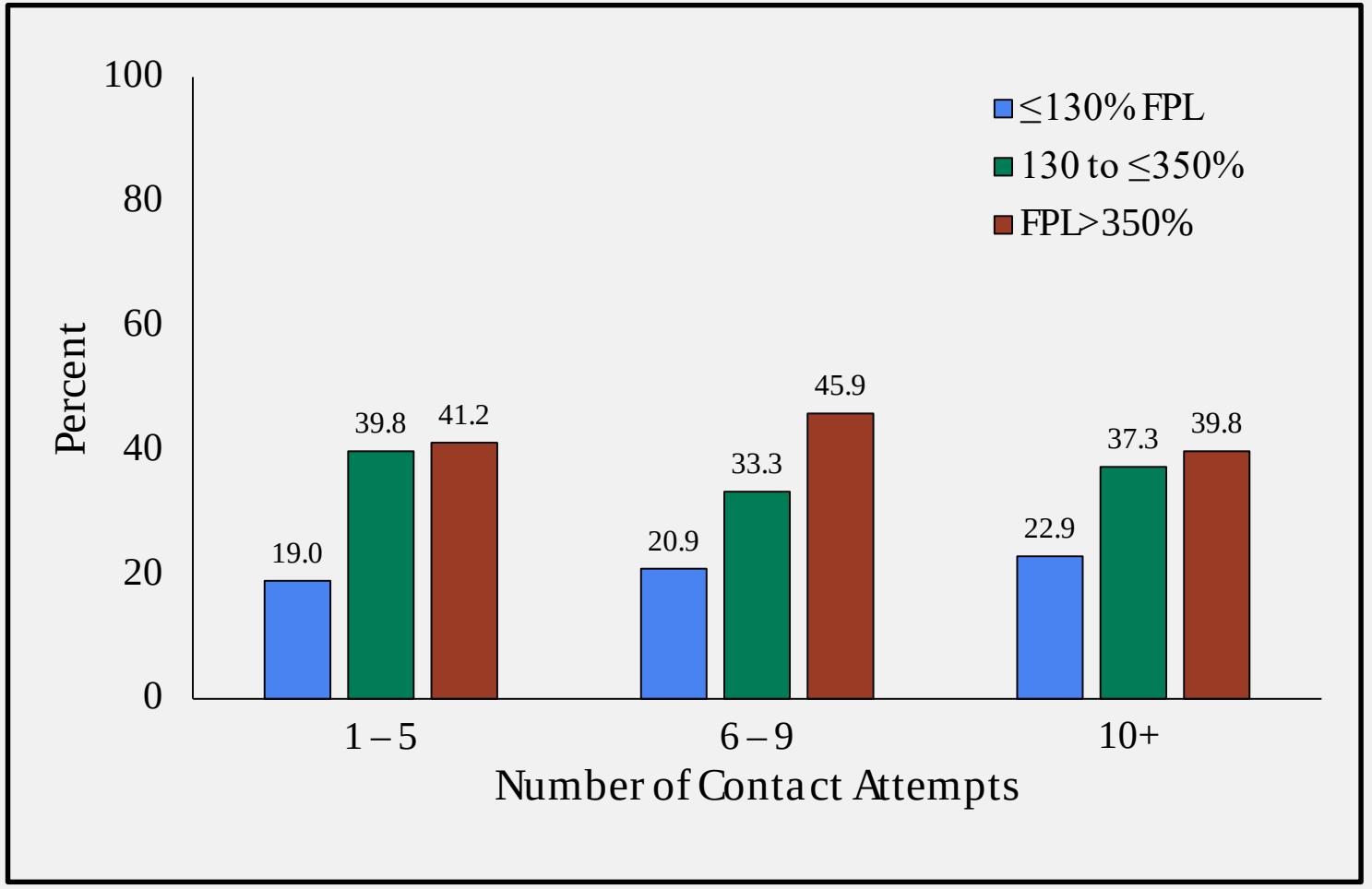
- Different distribution among early versus late respondents (*p<0.05*)
- Similar findings for children



Demographic Differences among Adults by the Number of Contact Attempts: NHANES 2015 – 2016

By Income:

- The distribution by income is not different.

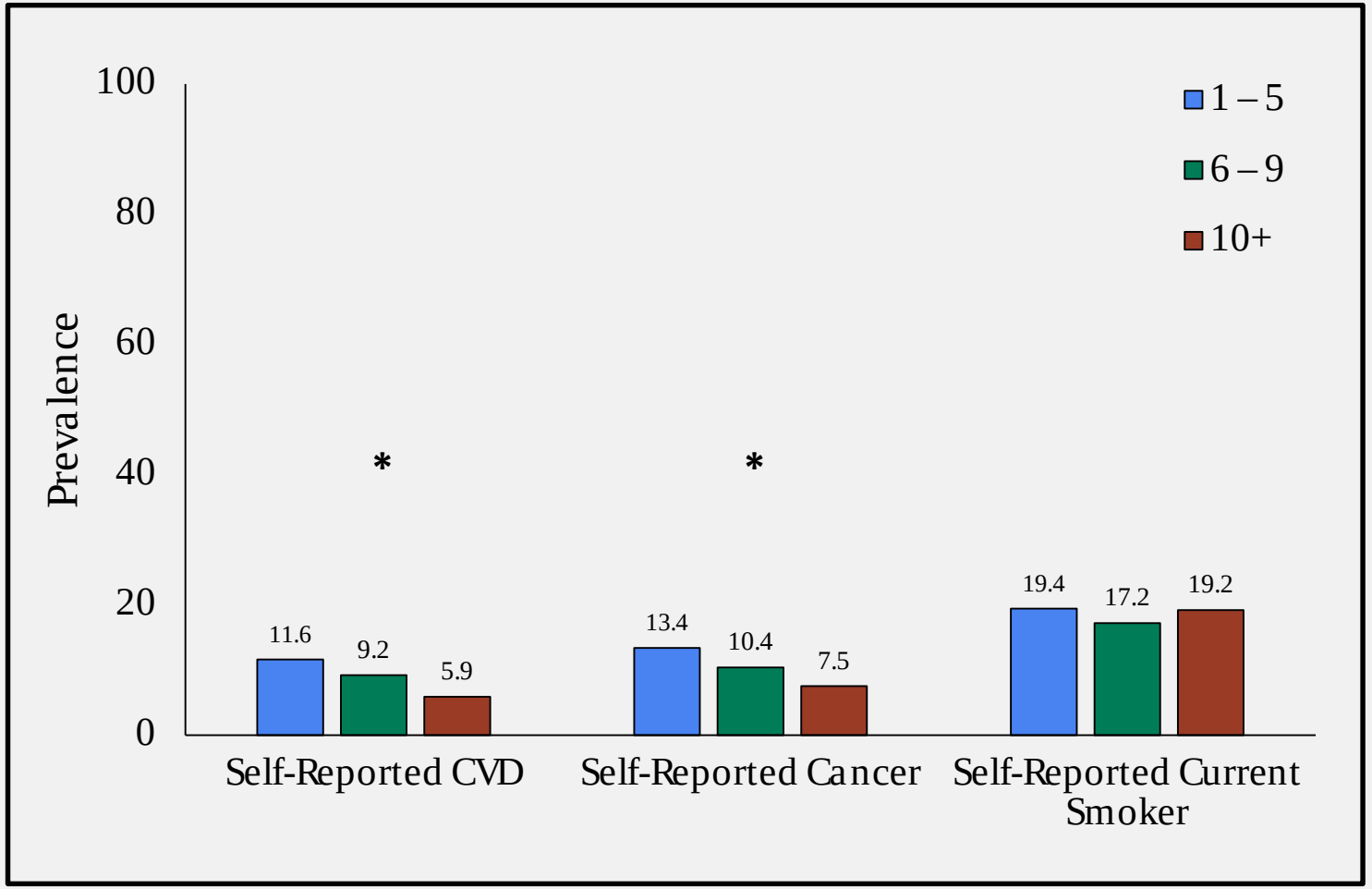


Differences in Health Characteristics between Early *vs* Late Respondents

Differences in Health Characteristics among Adults by the Number of Contact Attempts: NHANES 2015 – 2016

Self-Reported Health:

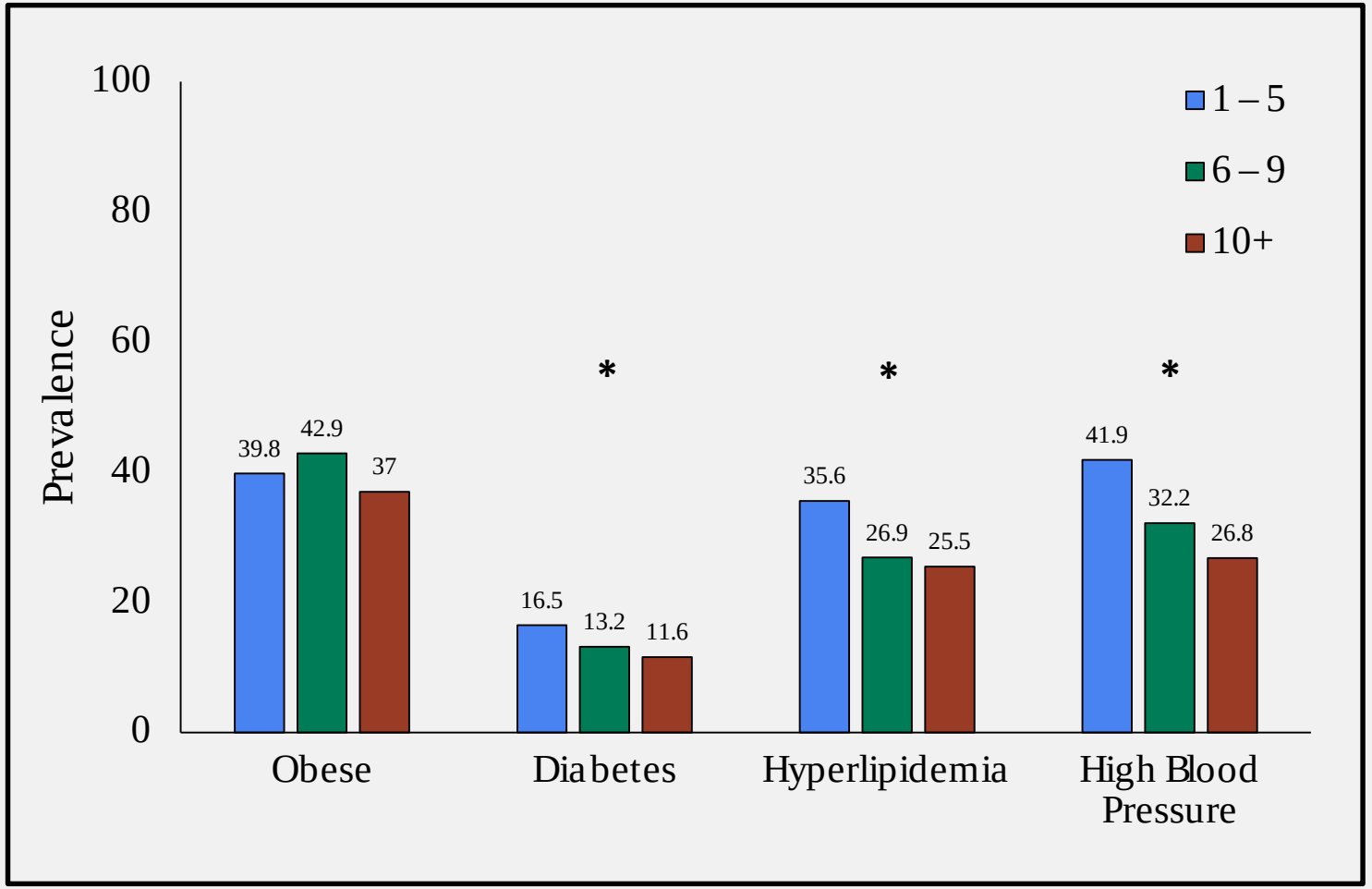
- Statistically significant differences (*) except for smoking status
- Prevalence lower among late respondents



Differences in Health Characteristics among Adults by the Number of Contact Attempts: NHANES 2015 – 2016

Measured Health:

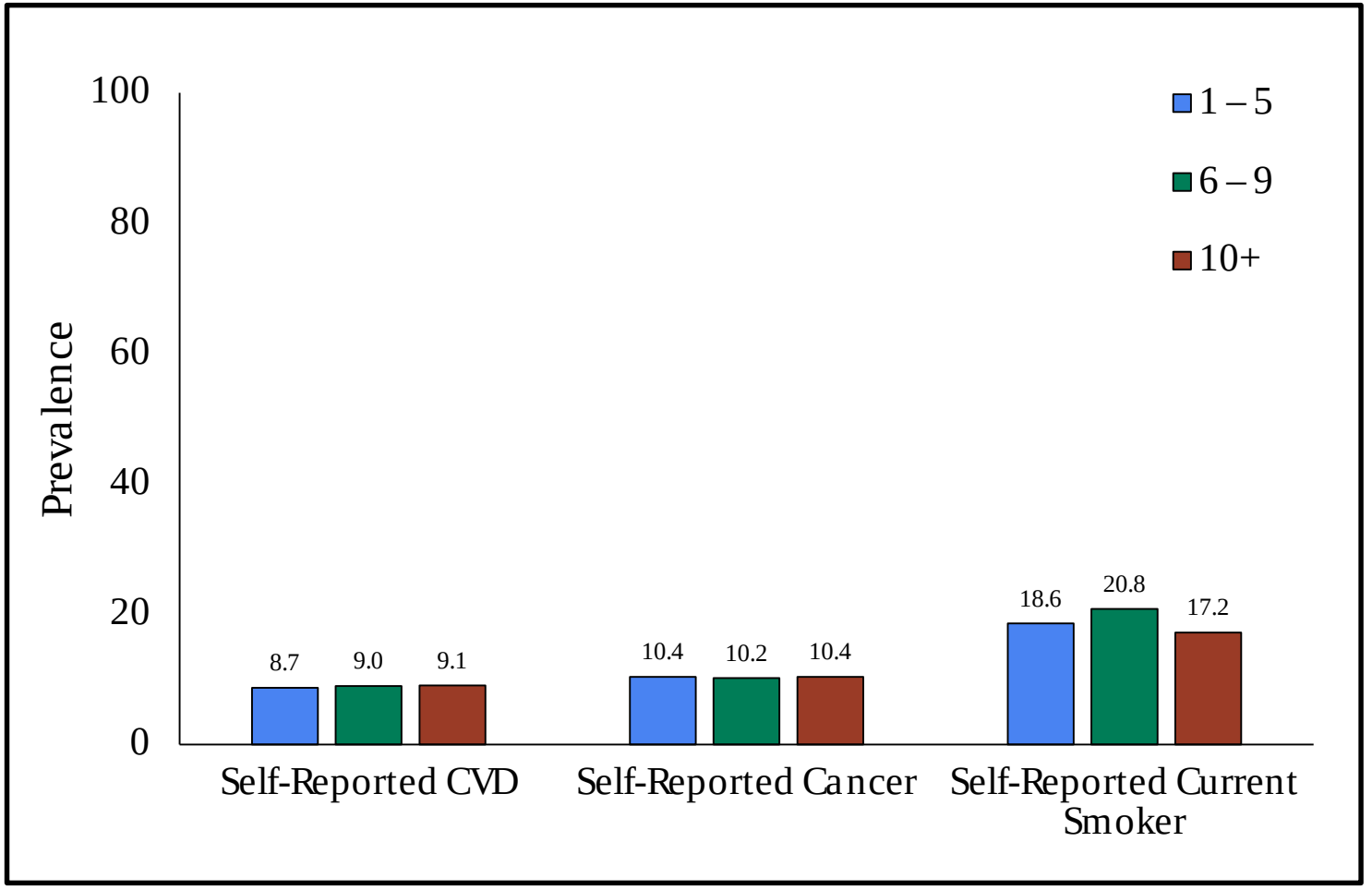
- Statistically significant differences (*) except for obesity
- Prevalence lower among late respondents



Most Differences Can be Explained by Age

Self-Reported Health after Age Adjusting:

- Predicated Marginal Proportions in SUDAAN
- No statistically significant differences



Characteristics of Late Respondents

(and maybe non-respondents?)

- Younger
- Non-Hispanic blacks and Hispanics
- HHs with children
- Healthier?

So, is our sample biased towards “less healthy” SPs?

Are NHANES participants “sicker” than NHIS participants?

	NHANES			NHIS		
	2001-2004	2011-2014		2001-2004	2011-2014	
Variable	Prevalence (SE)		Change (Δ)	Prevalence (SE)		Change (Δ)
Report of “Excellent” Health	**21.5 (0.6)**	**15.5 (0.5)**	-6.0	**29.6 (0.2)**	**28.6 (0.2)**	-1.0
Report of any Medical Condition	**53.0 (0.8)**	**56.0 (0.8)**	3.0	**43.4 (0.2)**	**45.6 (0.2)**	2.2

Significant differences between NHANES and NHIS at each time point are in **bold**.

What's going on?

- Non-response on NHANES may be explained by the "common cause model" or the "survey variable cause model"
- **Model 2:** missing at random on certain observable conditions and can be adjusted
- **Model 3:** not missing at random

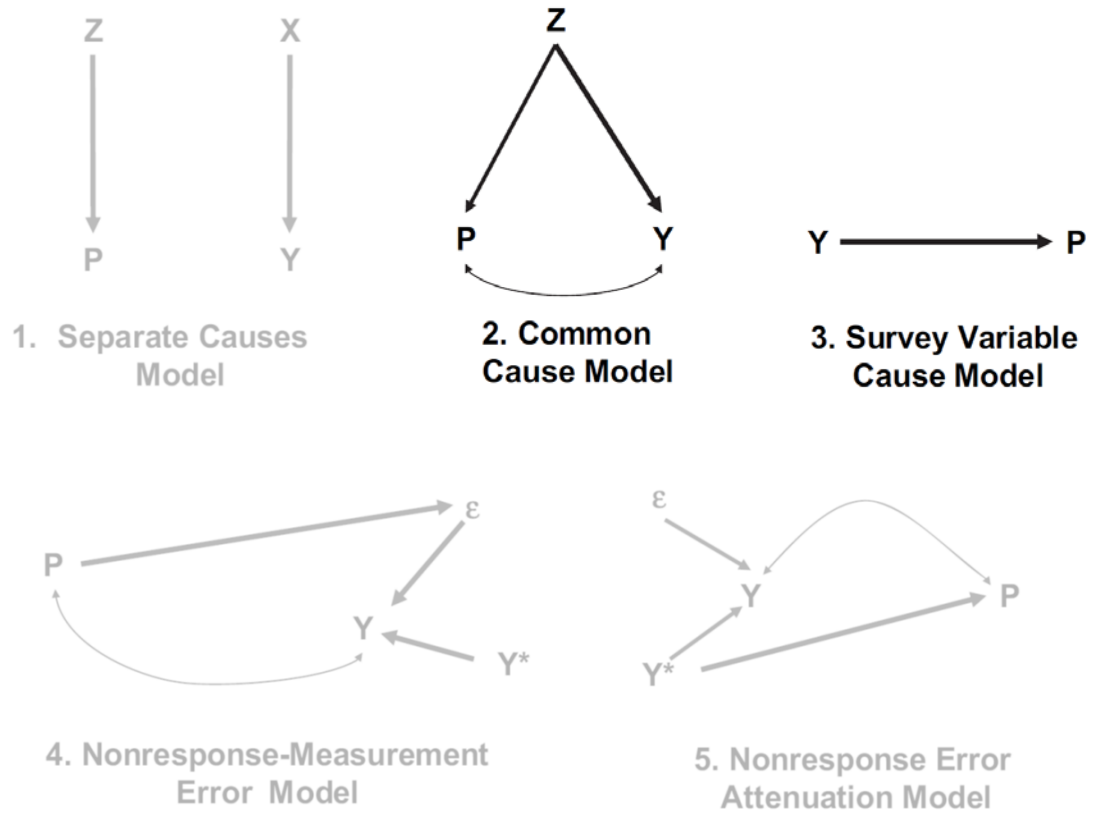


Figure 1. Five idealized causal models of response propensity (P), the reported survey variable (Y), the true value of the survey variable (Y^*) and other variables (X, Z) having different implications for nonresponse bias of the unadjusted respondent mean on the reported survey variable (Y).

Public Opinion Quarterly, Vol. 70, No. 5, Special Issue 2006, pp. 646–675

Conclusions

- NHANES response rates have declined over the past decade
- NHANES respondents more aware of their health status or sicker than non-respondents?
- Some NHANES estimates may be biased as assessed by certain analyses
- Extent of bias unknown and difficult to estimate

Limitations

- We still don’t have information on non-respondents
  - Follow-up studies? Non-response remains an issue for these studies
- Still unclear how to estimate the magnitude of the bias

Questions to the BSC

- Use of level of effort data in weight adjustments?
- Use of health estimates in weight adjustments?
- Conduct a non-response follow-up study?
  - Or capture health information on the screener?
- How to report bias in estimates to NHANES users?
  - Different results using different evaluation techniques

Thank you