NCHS BSC Nonresponse Bias Workgroup, National Health Interview Survey

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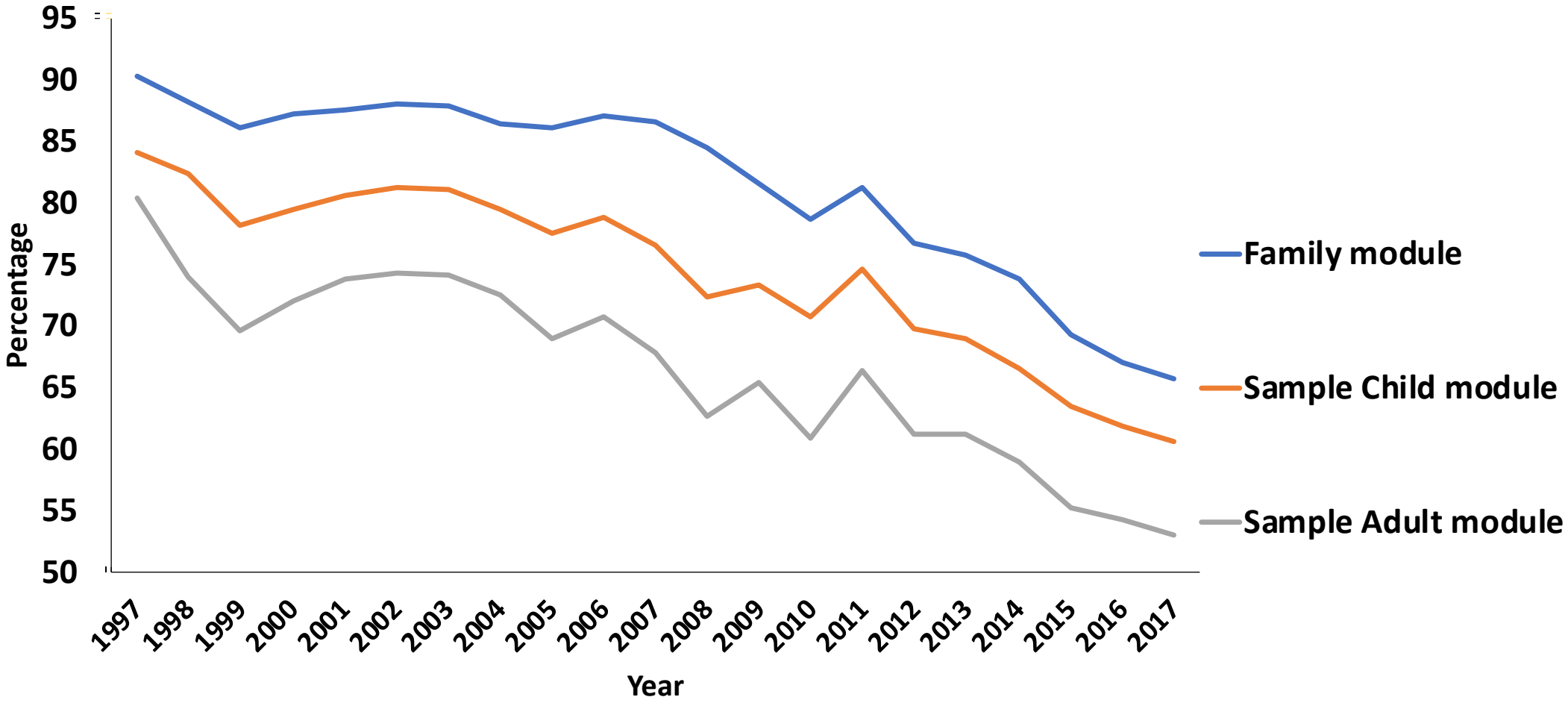
Need for Timely Feedback to DHIS

- Could not delay feedback to the next BSC meeting

- October 21st in-person meeting for NHIS and NHANES
  - Understanding of the problem
  - Comment on efforts to address the issue
  - Followed up with initial findings/opinions (several days later)

NHIS Family, Child, and Adult Response Rates, NHIS 1997-2017



NHIS Nonresponse Bias Analysis Goals

- Quantify nonresponse bias present in the redesigned NHIS
- Evaluate current NHIS weighting against other weighting methods
  - Focus on bias reduction in key health indicators
  - Take advantage of improvements in:
    - Auxiliary data and paradata
    - Machine learning methods and other advanced statistical models
- Obtain evidence for whether to implement a new weighting approach

➢ Contract awarded to ICF

Evaluating Tradeoffs

- Substantial reduction in nonresponse bias comes at a cost
  - Increased variance and design effects
  - Decreased effective sample size and reduced power
  - Increased complexity of application and replication
  - Reduced transparency in weighting process

Candidate Nonresponse Prediction Models/Methods and Reasons for Inclusion

Model Family	Candidate Model or Method Explored	Reason
Traditional Logistic Regression	**Single-level logistic regression**	- Simple to implement
		- Allows more nonresponse predictors (i.e., potential causes) than simple weighting classes
	Multilevel logistic regression	- In addition to single-level logistic regression's benefits, this model allows incorporating geographic or operational clustering (e.g., households within a field-representative's assignment)
		- Still simple to implement in SAS and other common statistical packages
Machine Learning Methods	**Random forest method**	- Potential to include more predictors than regression, and with less intervention from the researcher in predictor selection
		- More comprehensive than basic decision tree methods
		- Like random forest and other machine learning methods, LASSO has potential for better prediction than regression methods, and may make it easier to incorporate a large number of predictors
		- Compared to random forests, LASSO produces output more similar to traditional regression models

Relative Advantages of the Multilevel Model and Random Forest Method in Nonresponse Adjustments

Nonresponse Adjustment Method	Relative Advantages		
	Statistical	**Implementation**	**Effects on Estimates**
Multilevel Model	- Can account for clustering effects	- Programmed completely in SAS	- Demonstrates change in estimates (expected bias reduction) when compared with the baseline method
	- Interpretable regression coefficients and p-values	- Does not require a hyperparameter tuning stage to finalize the model	- On average, slightly smaller variance for estimates when compared with the random forest method
Random Forest Method	- Can account for complex interactions without direct specification	- Automated variable selection	
	- Can produce a model using a large number of predictors without overfitting		- On average, slightly larger change in estimates when compared with the multilevel model

Workgroup Findings from October 21st

Finding 1: The model contains endogenous variables, which might be better left out given they define nonresponse and dominate the model.

- Removing these variables should lower variance with similar or perhaps even improved bias impact.
- Notable are Noncontact reason: Completed case, Soft refusal at contact, Count of reluctance occurrence, and Count of noncontact phone interviews.
- Additional variables to consider dropping are reasons for refusal/nonresponse.

Workgroup Findings from October 21st

Finding 2: There are advantages to utilizing a methodology that is easier to understand and more familiar to users

- NCHS should assess the performance of the single level logistic regression approach.
- Can reduce the risk of future estimation problems, given there are not large differences in performance.
- The single level logistic regression approach was dropped in favor of the multi-level logistic regression approach, so we cannot assess how the performance of the single level approach would have compared to that of the multi-level approach.

Workgroup Findings from October 21st

Finding 3: Final weighting could benefit from use of calibration utilizing raking

- Gender should be crossed with age and with race/ethnicity for the demographic marginal (gender x age, gender x race/ethnicity)
- A geographic variable should be added as a raking dimension (state or at least Census division).

Workgroup Findings from October 21st

Finding 4: NCHS could draw repeated samples from the 1Q2019 NHIS sample

- This would involve treating the full 1Q2019 sample as the population and each subsample as a new sample.
- Doing this could induce some of the problems that NCHS is experiencing in an environment where the "truth" is now known

Workgroup Findings from October 21st

Finding 5: Nonresponse will likely continue to increase, and having a person level nonresponse adjustment step allows for future enhancements as appropriate

- The person level nonresponse adjustment should be kept as part of the NHIS weighting methodology.

Workgroup Findings from October 21st

Finding 6: Using the inverse of the mean response propensity in each propensity stratum (e.g., quintile, decile, or ventile), instead of the inverse of the individual response propensities (or other method to reduce variance inflation), could be considered

- Could reduce loss in precision due to the nonresponse adjustment to the weights.
- This is the approach used in the NSFG nonresponse adjustments.

Workgroup Findings from October 21st

Finding 7: The set of predictor variables for the nonresponse model should be reconsidered annually

- The model parameters can be updated within a year as more quarters become available, and finalized once 4th quarter data are available.

Questions for the Workgroup / Discussion