

Should Specific Households be Targeted for FedEx reminders?

Evidence from the National Household Education Surveys Program (NHES)

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Outline

- Introduction
 - NHES
 - Motivation: *Can we micro-target specific households to receive a more expensive mailing?*
- Findings
- Implications
- Limitations/future direction

National Household Education Surveys Program (NHES)

- Household education survey sponsored by National Center for Education Statistics (NCES)
- Two stage address-based sample (ABS)
- Last official administration was in 2016; web test administration in 2017; next official administration is in 2019
- Mailing protocol involves sending FedEx mailing as a nonresponse follow-up.

Mailing Protocols

- NHES 2016 official administration



- NHES 2017 web test administration



Initial Observations

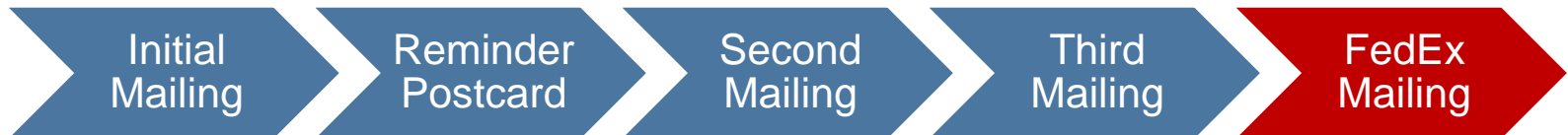
- In NHES 2016 administration, we observed that some subgroups (compared to others) responded at a higher rate to the FedEx mailing.
 - *Example:* Households with Hispanic heads of households, households with lower income, households in rural areas.
 - However, in addition to the mailing sent via FedEx it was also the first time the household received a paper survey. Hence, it is difficult to differentiate which factor led to the increase.
- In NHES 2017 administration, we included an **experiment** where sample members were randomly assigned to receive the third screener mailing via FedEx or Priority First Class Mail.
 - FedEx led to a 3 percentage point screener response rate gain.
 - Certain households such as those with Hispanic heads of households were significantly more likely to respond to FedEx versus First Class Mail.

Motivation for Research Question

- NHES 2019 will include an experiment that attempts to identify cases that are **least** likely to be impacted by FedEx mailing.
 - More FedEx Sensitive Cases



- Less FedEx Sensitive Cases



Research Question

- Can we accurately predict sampled cases' sensitivity to FedEx mailings – both in the sample on which the model is originally estimated and in a separate validation sample?
- Can we use these sensitivity scores to identify cases that should receive a less expensive First Class mailing instead of a FedEx mailing in early mailings?

Methods

- Analytical Sample: NHES: 2017 cases
 - We chose to use this sample because of the inclusion of the FedEx/First Class experiment.
 - Excluded
 - » ineligibles,
 - » P.O. Box addresses (since FedEx doesn't deliver to P.O. Boxes),
 - » households that received a \$2 incentive (since the 2019 survey will use a \$5 incentive).
 - Approximately 76,000 cases remained (about half of which received FedEx and half of which received First Class mailing)

Methods-2

- **Modeling Approach**

- **Binary Logistic Regression**

- » **Outcome:** 0=Nonrespondent 1=Respondent

- » **Predictors:** Available Frame Variables*, Block-level Census Planning Database Variables*, FedEx Recipient Indicator Variable (FedEx)

- Each variable included as a main effect

- An interaction term included between each of the variables and the FedEx Recipient Indicator Variable.

- Forward stepwise selection used to narrow down the predictor variables

- » **Specification**

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \alpha \text{FedEx} + \sum_p \beta_p x_p + \sum_p \gamma_p x_p \text{FedEx}$$

Where p is the probability of screener response rate; β_0 is a constant; FedEx is the FedEx indicator; and x_p 's are predictors.

*List available at the end of presentation

Methods-3

- **Sensitivity:**

- The change in the case's probability of being a screener respondent when sent a FedEx mailing, relative to its probability of screener response when sent a First Class mailing.

$$\text{Sensitivity}_{FedEx} = p_{FedEx} - p_{FirstClass}$$

Where p_{FedEx} is the probability of the cases responding having received a FedEx mailing and $p_{FirstClass}$ is the probability of responding having received First Class mailing.

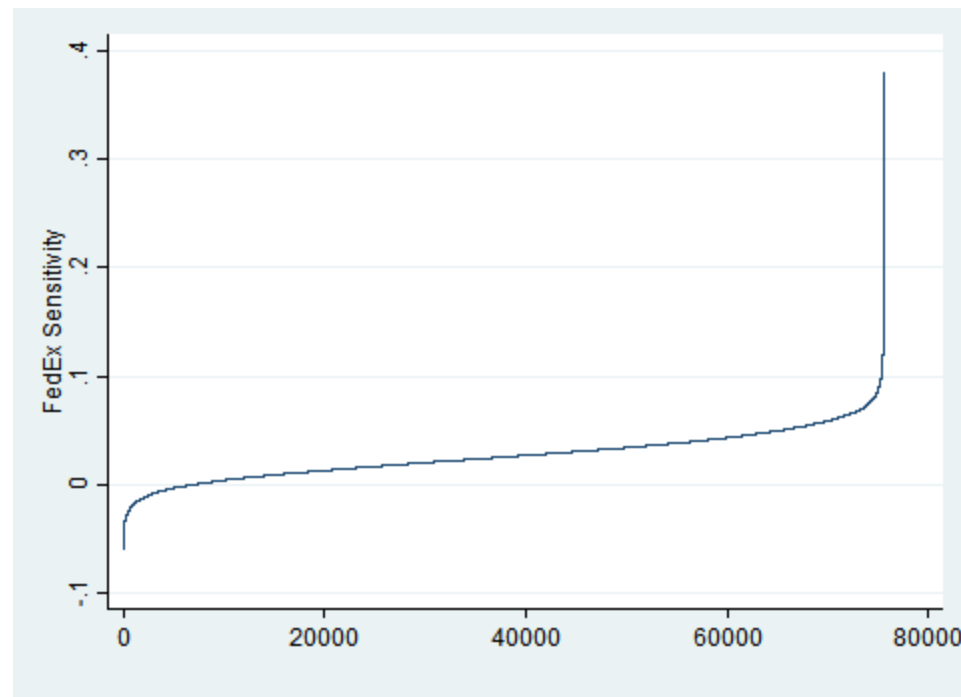
- To obtain p_{FedEx} for the First Class cases, we used the logistic regression model estimated above with the value of the FedEx indicator set to 1 for all cases (regardless of their actual mailing condition).
- To obtain $p_{FirstClass}$ for the FedEx cases, we used the logistic regression model estimated above with the value of the FedEx indicator set to 0 for all cases (regardless of their actual mailing condition).

Findings-Model Performance

Model Fit Characteristics	Final Model
McFadden's R-squared	0.054
Accuracy Rate	63.07%
AUC	0.6611

Finding-Range of Sensitivity Scores

- Plot of sensitivity score does not suggest any particular grouping; hence, we decided to use quartiles of the sensitivity score as 4 groups.



Finding-Utility

Table 1: Predicted and actual response rates for FedEx and First Class mailing protocols by FedEx sensitivity group using binary logistic regression modeling approach

	Predicted			Actual		
	Response Rate: FedEx	Response Rate: First Class	FedEx treatment effect	Response Rate: FedEx	Response Rate: First Class	FedEx treatment effect
Group 1	42%	42%	0%	42%	42%	0%
Group 2	42%	40%	2%	43%	40%	3%
Group 3	44%	40%	3%	43%	41%	2%
Group 4	46%	40%	5%	46%	40%	6%

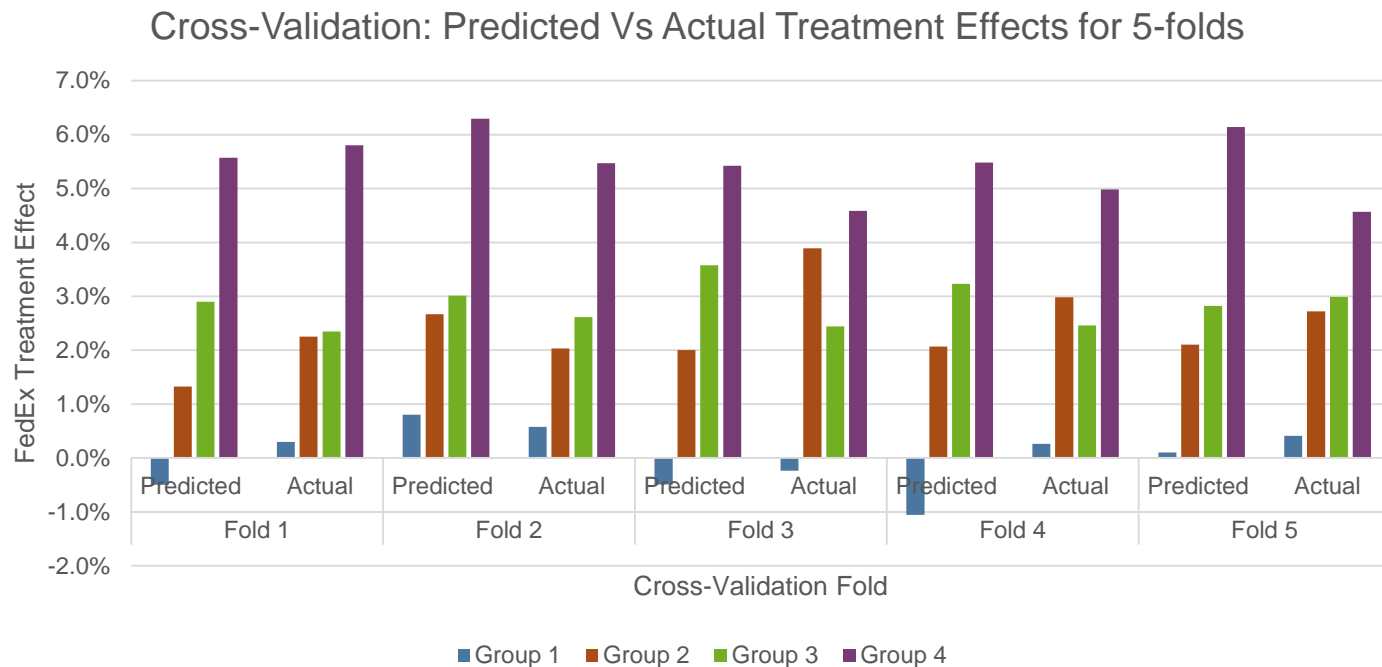
Finding-Response Propensity Vs Sensitivity

Table 2: Proportion of cases within each sensitivity group that received each of the mailings in NHES: 2017

	Mailing 1	Pressure-sealed envelope	Mailing 2	Mailing 3
Group 1	100%	100%	73%	65%
Group 2	100%	100%	74%	66%
Group 3	100%	100%	74%	66%
Group 4	100%	100%	74%	65%

Finding-Cross Validation

- We performed 5-fold cross validation to confirm external validity of the model developed (i.e., modeling with 80% of cases and testing with the other 20%).



Finding-Representativeness

- Assessed size of change of base-weighted absolute relative nonresponse bias assuming that groups 2-4 receive FedEx mailing.
- Distribution of 67 frame variable characteristics were compared:
 - *Distribution 1*: Actual respondents vs eligible sample
 - *Distribution 2*: Predicted respondents vs eligible sample
- All significant base-weighted absolute relative biases (n=41) were present in both comparisons. However, distribution 2(compared to distribution 1) had the following changes.
 - 13 of the 41 characteristics had a 2 or more point decrease.
 - 17 of the 41 characteristics had a 0-2 point decrease.
 - 11 of the 41 characteristics had a 0-1.5 point increase.

Implications

- We are able to find groups that have different sensitivity scores.
 - Both in the test sample and validation samples.
- FedEx sensitivity seems to be different from response propensity
- In general targeting cases that are more sensitive to FedEx seems to increase respondent representativeness.

Limitations

- **Our model performance metrics indicate a poor fit**
 - We are investigating other modeling approaches and auxiliary frame variables to improve the model performance.
 - The accuracy rate reported is based on a deterministic approach; a stochastic approach shows a decline in accuracy rate.
- **Key differences between the NHES:2017 and NHES:2019 data collection protocols**
 - **Timing of FedEx mailing**
 - » In NHES:2017 the FedEx mailing was the third mailing while it will be the second mailing for NHES: 2019
 - **Mode of administration**
 - » NHES:2017 was a web-only administration while NHES:2019 will be a mixed-mode administration (with paper component.)

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Supplemental Materials-1

- **Sampling Frame Variables:**
 - Stratum, Poverty flag tract, Route type, Age of head of household, Gender of head of household, Number of adults in the household, Number of children in the household, Income of the household, Marital status of the head of the household, Tenure status of the house, Education of the head of household, Race/ethnicity of the head of household, Census region, Phone number availability, Dwelling type

Supplemental Materials-2

- **Block-level Census Database Planning Variables:**
 - Median household income for all households in the block, Percent of block population that is Black, Percent of block population that is Hispanic, Percent of block population between 5-17, Percent of block population between 18-24, Percent of block population between 25-44, Percent of block population between 45-64, Percent of block population 65 and over, Percent of block population living in mobile homes, Percent of block population where head of household is part of married couple, Percent of block population where head of a household has not completed high school, Percent of housing units considered usual place of residence, Percent of block population older than 5 that speaks a language other than English at home, Percent households in block that are rented, Low response score for block