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An Evaluation of the 2022 National Household Travel Surveys: A Total Survey Error Comparison of the ABS vs. the Probability-Based Panel NextGen NHTS Studies

2024 International Total Survey Error Workshop

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Evaluation Team

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National Household Travel Survey (NHTS)

- This survey has been carried out for the Federal Highway Administration (FHWA) of the U.S Department of Transportation periodically since 1969
- It produces “Official Statistics” about the out-of-home travel in which non-institutionalized residents of the U.S., aged 5 years of age or older, engaged each day within the study year
- For the 2022 NHTS, two probability-based survey designs were carried out simultaneously by the same contractor from late January 2022 through late January 2023 using the same English-language and Spanish-language CAWI questionnaires

2022 NHTS Independent Evaluation

- The FHWA funded an independent evaluation from 2021-2024 comparing the two 2022 NHTS studies.
  - Which we chose to conduct using a Total Survey Error approach.
- The TSE-guided evaluation was carried out by the Paul J. Lavrakas (as Survey Methodological SME), Trent Buskirk (as Survey Statistical SME) and the Battelle Memorial Institute (Alan Pate, Elizabeth Slone, Ta Lui, and Filmon Habtemichael).
- The purpose of the evaluation was to gather information that would allow the evaluators to opine on where the two surveys, compared to each other, produced comparable findings for the “core attributes” that the NHTS gathers and whether those findings were likely to be “fit for purpose”.

Overarching Conclusions

- Based on our evaluation of two 2022 NHTS surveys, we concluded that:
  - The two surveys, as designed and implemented, basically led to the same conclusions regarding the core attributes measured by the NHTS 2022 questionnaire.
  - Both the 2022 ABS NHTS and 2022 PFS NHTS were judged to be “Fit for Purpose”.

2022 NHTS ABS Design

- Initial U.S. residential address sample purchased from MSG
- Stratified by Urban/Rural status and Census Regions
- As many as four recruitment mailings were sent to 72,822 addresses, January 2022 to January 2023
- 7,893 completed households (mixture of CAWI and paper mailback; 99+% CAWI)

- **This survey produced the official national household travel statistics for Americans in 2022.**

2022 NHTS PFS Design

- Initial unstratified sample* drawn from an existing U.S. residential panel frame of the survey contractor
  - Panel built over 25 years using Landline-RDD, Dual Frame RDD, and ABS frames
- As many as four email invitations were sent to 18,161 panelists, January 2022 to January 2023
- 7,468 completed households (100% CAWI)

* Panelists were selected from the survey contractor's panel frame using variables that were used to create sampling strata for the ABS survey in addition to other household variables that might be better proxies for travel-related outcomes

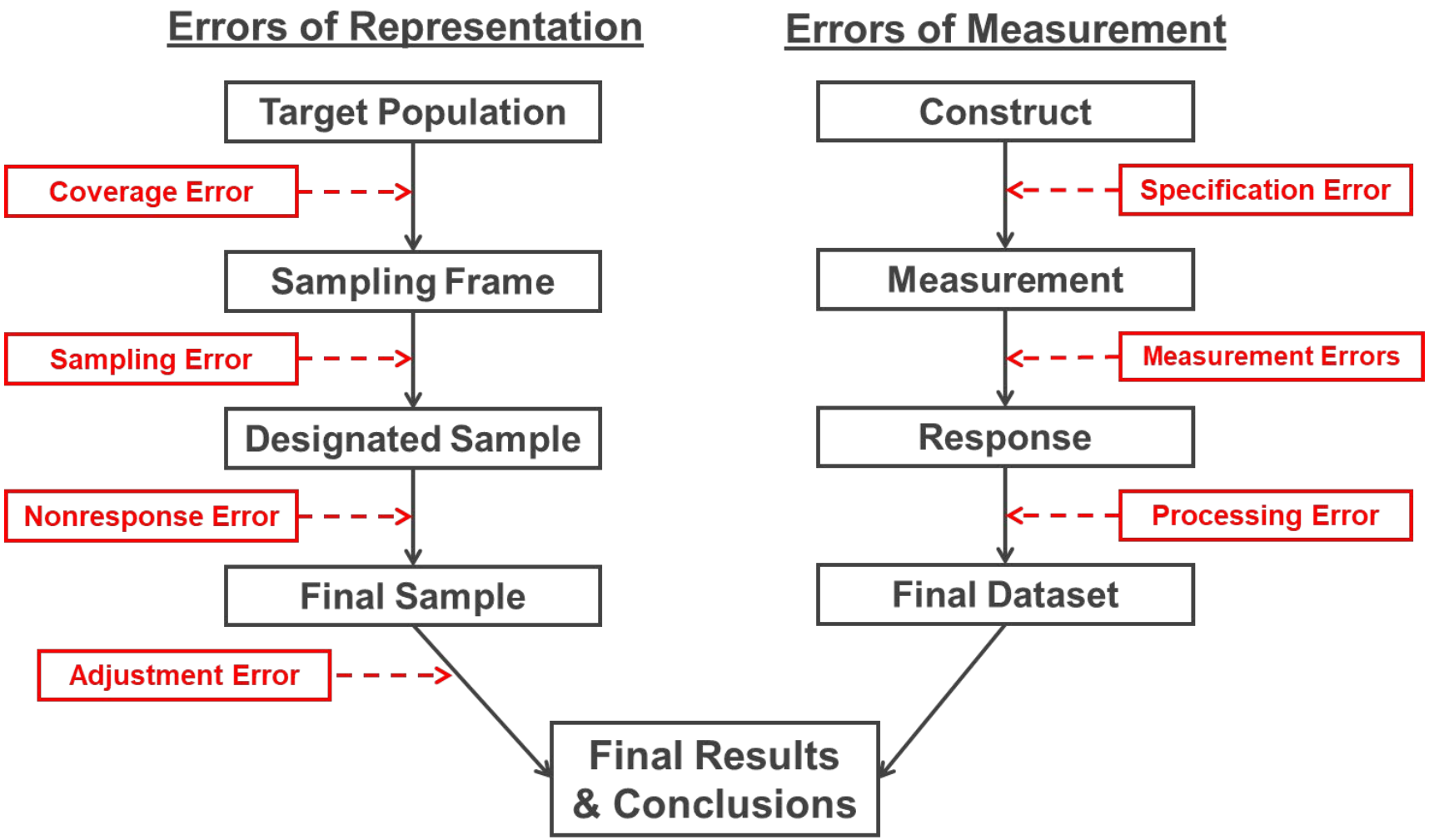
Methodological/Statistical Approach

- Our Evaluation was guided by the TSE Framework
- Gathered detailed information from FHWA and the survey contractor about the methods used in each 2022 survey
  - Almost all requested information was provided
- Identified where differential methods/statistics were used by the survey contractor

Methodological/Statistical Approach (cont.)

- Conducted statistical analyses comparing data for the NHTS core attributes in each survey to identify nonignorable differences in the two datasets
  - That is, differences < .05 in significance and greater than 5% in magnitude
  - Used the Bonferroni-Holm method to conservatively adjust p values for the multiple simultaneous comparisons by controlling the familywise error rate (0.05)
- Related those differential methods to meaningful differences in core attributes between the two 2022 surveys

Total Survey Error Framework



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Total Survey Error Framework (continued)

- Errors of Representation
  - Coverage Problems and Errors
  - Sampling Design Problems and Errors
  - Nonresponse Problems and Errors
  - Adjustment Problems and Errors
- Errors of Measurement
  - Specification Problems and Errors
  - Respondent-related Measurement Problems and Errors
  - Other types of Measurement and Errors
  - Processing Problems and Errors

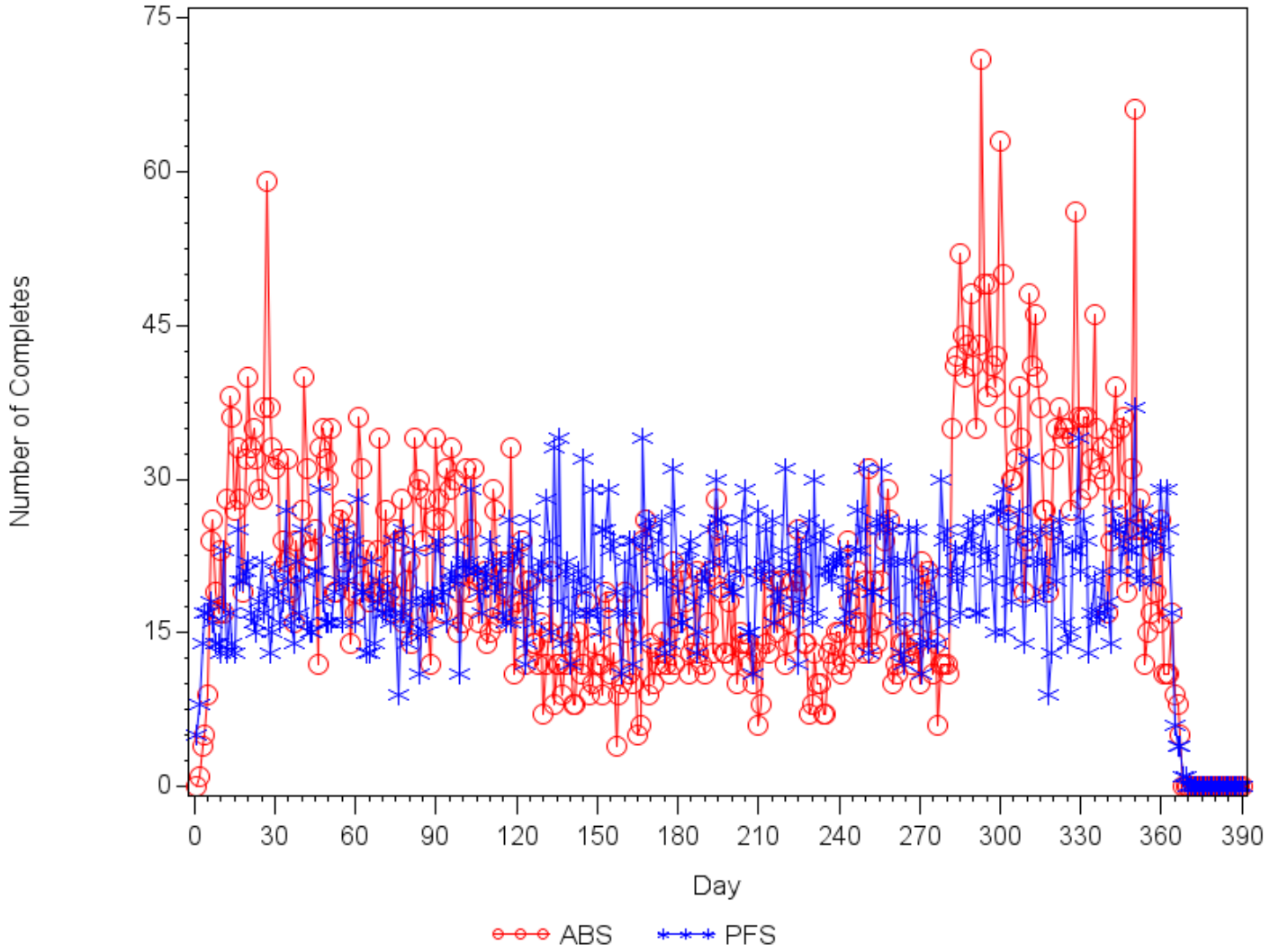
ABS Coverage and Related Error

- The ABS initial survey sample was drawn from the current MSG national frame; stratified by urban/rural status and census regions.
- It was reasoned that the amount of noncoverage in the ABS design was likely small.
- However, using zip-code level 2020 Census data and more recent ACS auxiliary data we found that the 2022 NHTS ABS initial sample differed from the target population by *undercoverage* of areas more likely to be populated by African Americans, Hispanics, young adults, those with less than a 9th grade education, and those with at least a Bachelor's degree, as well as having large residential buildings, households without vehicles, and urban dwelling units.
- The evaluation team reasoned that the amount of coverage error that the ABS frame may have contributed to its survey's findings was very small, but very likely to be greater than the amount of coverage error that the PFS frame contributed to its survey's findings.

PFS Coverage and Related Error

- The PFS survey sample came from the contractor's national panel which over its 25 years used several different national frames
- It was reasoned that the amount of noncoverage in the PFS design was negligible (likely close to zero)
- The evaluation team reasoned that the amount of coverage error that the PFS frame may have contributed to its survey's findings was very likely close to zero.

Number of Completed Cases per Day



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ABS Sampling and Related Error

- Point estimates derived from the two surveys were largely consistent for the vast majority of the NHTS core attributes.
  - No meaningfully statistically significant differences were seen in the travel metrics.
- The width of the resulting confidence intervals around the point estimates were generally wider, on average, for the ABS survey compared to the PFS survey.
  - For 497 of 599 (83%) estimates, the confidence interval for the ABS estimate was wider than that for the corresponding PFS estimate. Half of the ABS intervals were at least 32% wider than those from the PFS and about 25% of them were at least 46% wider.
  - That is, the ABS estimates were less precise than the PFS estimates.

ABS and PFS Response Rates

Rate	2022 ABS NHTS	2022 PFS NHTS
AAPOR RR3	11.8%	1.9%
AAPOR COOP	12.5%	43.6%

ABS Nonresponse and Related Error

- The ABS responding sample differed from the nonresponding sample by being more likely to live in zipcodes that were:
  - less heavily populated by African Americans and Hispanics
  - less likely to be populated by those with low educational attainment
  - more likely to be populated by those with higher-SES
  - less likely to have households without vehicles
  - more likely to have residents complete the 2020 Census via the Internet.
- There were numerous meaningfully significant differences between the ABS-responding final sample and the parameters for the NHTS's target population.
- Overall, most of these differences show that the final ABS sample very likely underrepresented the proportion of lower-SES households in the target population.

PFS Nonresponse and Related Error

- The PFS responding sample differed from the nonresponding sample by being more likely to live in zipcodes that were:
  - less heavily populated by African Americans and Hispanics
  - less likely to be populated by those with low educational attainment
  - more likely to be populated by those with higher-SES
  - less likely to have residents complete the 2020 Census via the Internet.
- The final PFS sample underrepresented the proportion of lower-SES households in the target population.
- However, the extent of the underrepresentation in the PFS-responding final sample was less than in the ABS-responding final sample.

Respondent-related Measurement and Related Error

- As with any panel-frame-based survey, the data that were produced by the usage of panelists in the 2022 PFS survey may have been affected by “panel conditioning” (i.e., effects that affect the data quality among some long-term panelists).
  - However, this remains uncertain, as it was outside the scope of the evaluation to investigate the presence of panel conditioning in the survey contractor’s panel.
  - These possible respondent-related measurement error effects do not apply to the cross-sectional (one-time) ABS survey.

Summary

- There were very few observed statistical differences between core attributes in the NHTS 2022 ABS and PFS surveys that were judged to be “meaningfully” different
- These might be explained by the differential methods and statistics that were identified as being used in each survey that were associated with:
  - Coverage Differences
  - Sampling Design Differences
  - Nonresponse Differences
  - Weighting Differences
  - Respondent-related Measurement Differences

Conclusion

- Using a *Total Survey Quality* (Lyberg and Biemer, 2002) perspective, the evaluation team concluded that in comparison to the 2022 ABS NHTS (which produced the official statistics for residential travel in the United States for 2022), had the official statistics for the 2022 NHTS been generated via use of the 2022 PFS NHTS, there essentially would have been no important differences in results.
- Both of the 2022 NHTS designs were judged to be “Fit for Purpose” in yielding high-quality national residential travel statistics.

Thank You!

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