KnowledgePanel® Sample Representativeness & Related Topics

A METHODOLOGY MEMORANDUM

When our clients submit research manuscripts based on KnowledgePanel studies to peer-reviewed journals, they are often asked to disclose details of our sampling, data collection, and weighting procedures, or to offer empirical evidence addressing concerns about biases that can result from self-selection or differential nonresponse. To meet those needs, this methodological brief provides an overview of statistical procedures used for KnowledgePanel, along with a summary of independent studies conducted to assess the representativeness of KnowledgePanel samples.

Processes and procedures of KnowledgePanel:

- **Sampling Methodology:** To provide a representative sample of households in the US, we use an address-based sampling (ABS) methodology to recruit new members into KnowledgePanel. A stratified random sample of addresses is selected from a sampling frame of US households to replenish KnowledgePanel.

- **Sampling Frame:** The sampling frame from which KnowledgePanel members are recruited is the universe of all US residential addresses, secured from the latest Delivery Sequence File (DSF) of the US Postal Service. This database provides a complete listing of all occupied residential points of delivery in the US, and thus covers cellphone-only households.

- **Sample Selection Methodology:** One of the important advantages of the DSF-based ABS methodology is the possibility of complex stratification for sample selection. Our samples are stratified to increase the selection rates for hard-to-reach household types with lower recruitment rates or higher attrition rates, such as Hispanic households, households with residents with lower educational attainment, and those including young adults.

- **Inclusion of Non-internet Households:** We give complementary tablets and pay for cellular data plans for KnowledgePanel households that do not have internet access or email. We also offer technical support to households that need help connecting to the internet to access their surveys.

- **Inclusion of Spanish-Language Households:** Our recruitment methodology targets Spanish-language households to ensure KnowledgePanel reflects all US adults. We start by oversampling high-density Hispanic areas to increase the contact rate, and we also conduct an additional recruitment effort, called Latino Supplement, to target adults who speak Spanish at home most of the time. Our recruitment mail-out materials and telephone follow-up contacts are in both English and Spanish to ensure no language barriers inhibit recruitment of this population.

- **Incentive Plan for Recruitment:** Our mail-based panel recruitment methodology includes a modest cash incentive ($1) to increase our recruitment success rates. Also, we rely on seasoned telephone interviewers for nonresponse follow-up (NRFU) when contacting a subset of nonresponding households for which a corresponding telephone number has been secured.

- **Managing Membership Burden**: Given the significant investments for panel recruitment and upkeep, we are highly mindful of the burden members may experience when participating in KnowledgePanel. We have designed policies and procedures to minimize that burden. Our panelists complete about 3 KnowledgePanel surveys per month on average.

- **Panel Maintenance and Retention:** Our panel maintenance and retention programs encourage members to see that they are contributing to and are part of a feedback system for decision-makers in the government and private sector. To that end, we offer incremental incentives as a token of our appreciation and make sure members are invited to a diverse set of surveys. We also regularly collect feedback from KnowledgePanel members related to their experience so we can ensure that the needs of our members are being met.

Beginning in 2023, we implemented new strategies to manage the panel member experience. Examples include random spot bonuses, targeted bonuses based on tenure or other milestones, and periodic check-ins . These measures have increased survey completion rates and lowered attrition rates as evidenced in the tables below.

| | Completion Rate of Surveys that Fielded for 5+ Days - Comparison by year | | | | | | | | | |
| | Overall | | | English | Spanish | Average Completion Rate for Key Demos | | | | |
	Average Completion Rate	Average Breakoff Rate	Average Days in Field	Average Completion Rate	Average Completion Rate	60+	Low Income	Minorities	Low Education	Black or African American, Non-Hispanic
2020	60%	N/A	18	60%	45%	73%	51%	52%	55%	51%
2021	58%	8%	17	59%	40%	70%	50%	50%	53%	50%
2022	55%	10%	21	56%	39%	68%	49%	49%	51%	50%
2023	62%	9%	19	63%	41%	72%	56%	56%	59%	59%
2024	63%	7%	17	64%	43%	73%	56%	58%	58%	60%
2025 Q1	65%	6%	15	66%	44%	75%	58%	61%	62%	62%

| | Average Monthly Attrition Rates - Comparison by year | | | | | | | |
	Overall	English	Spanish	18-29	HS or Less Education	Black non-Hispanic	Hispanic	Rare Groups
2020	3.5%	3.5%	4.2%	6.1%	5.2%	4.7%	4.7%	7.7%
2021	4.7%	4.5%	6.6%	7.9%	7.1%	6.0%	6.5%	11.3%
2022	4.8%	4.7%	6.9%	8.5%	7.0%	6.2%	6.8%	10.7%
2023	3.7%	3.6%	4.9%	6.4%	5.5%	4.8%	5.1%	8.3%
2024	3.2%	3.0%	4.9%	6.0%	4.6%	3.8%	4.6%	6.5%

Representativeness of KnowledgePanel samples

When articles based on sample survey data are submitted to journals, reviewers often comment on the representativeness of the employed samples. Surveys that used KnowledgePanel meet reviewers' high standards for representative, probability-based samples. Below we discuss the statistical representativeness of KnowledgePanel and the systematic biases of nonprobability samples. This is followed by an overview of methodological studies addressing external validity, self-selection bias, nonresponse bias, KnowledgePanel members compared to non-recruited individuals, social desirability bias, and mode contents effects.

Statistical Representativeness

Significant resources and infrastructure are devoted to the KnowledgePanel recruitment process so that the resulting panel can properly represent the US adult population. This representation is achieved not only with respect to a broad set of geodemographic distributions, but also for hard-to-reach adults – such as those without landline telephones or Spanish-speaking survey-takers. Consequently, the raw distribution of KnowledgePanel mirrors that of the US adults fairly closely, barring occasional disparities that may emerge for certain subgroups due to differential recruitment and attrition rates.

For selection of samples from KnowledgePanel, we use a patented methodology that ensures the resulting samples behave as EPSEM (equal probability of selection method) samples. Briefly, this methodology starts by weighting the entire KnowledgePanel to the benchmarks secured from the latest March supplement of the US Census Bureau's Current Population Survey (CPS) along several dimensions. This way, the weighted distribution of KnowledgePanel aligns with that of US adults – even with respect to the dimensions where minor disparities may result from differential recruitment or attrition rates. Typically, the geodemographic dimensions used for weighting the entire KnowledgePanel include:

- *Gender (Male and Female)*
- *Age (18–29, 30–44, 45–59, and 60+)*

- *Race/Hispanic Ethnicity (White/Non-Hispanic, Black/Non-Hispanic, Other or 2+ Races/Non-Hispanic, Hispanic)*
- *Education (Less than High School, High School, Some College, Bachelor and beyond)*
- *Census Region (Northeast, Midwest, South, West)*
- *Household Income (Under $10k, $10K - <$25k, $25K - <$50k, $50K - <$75k, $75K - <$100k, $100K - <$150k, $150K+))*
- *Home ownership status (Own and Rent/Other)*
- *Metropolitan Area (Yes and No)*
- *Household Size (1, 2, 3, 4+)*
- *Marital Status (Married, Not Married)*
- *Hispanic Origin (Mexican, Puerto Rican, Cuban, Other, Non-Hispanic)*
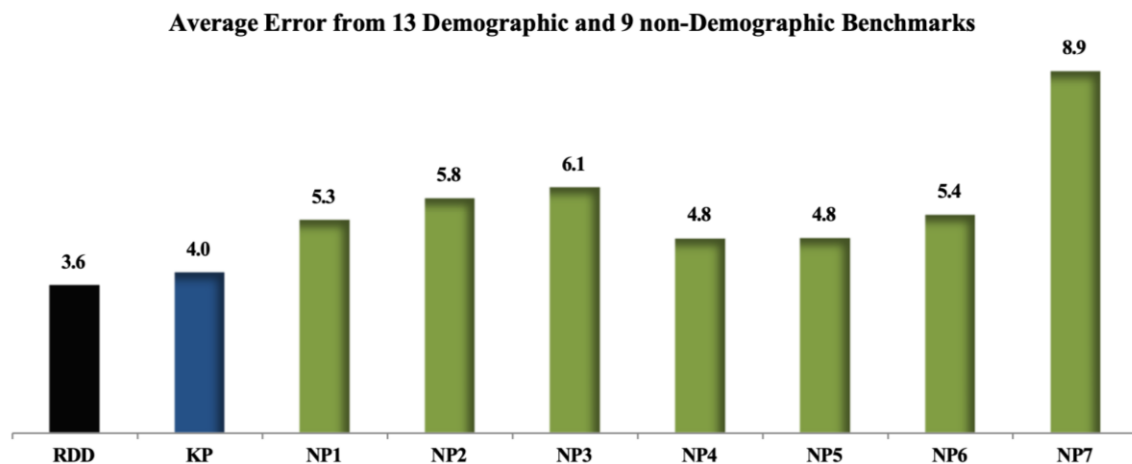- *Political Party Identification (Republican, Democrat, Independent/Something else/Refused/Missing)*

Then, using the above weights as the measure of size (MOS) for each panel member, a probability-proportional-to-size (PPS) procedure is applied to select study-specific samples. It is the application of this PPS methodology with the above MOS values that produces fully self-weighing samples from KnowledgePanel, for which each sample member can carry a design weight of approximately unity. Moreover, in instances where the study design requires any oversampling of specific subgroups, such departures from an EPSEM design are corrected by adjusting the corresponding design weights to CPS benchmarks.

External Validity of Survey Estimates

A landmark study was conducted by Yeager et al. (2009) providing a comprehensive comparison of KnowledgePanel survey results to those obtainable from random-digit dial (RDD) telephone surveys, as well as several online surveys based on nonprobability samples.[1] The authors administered parallel surveys using the same instrument with different samples: two probability-based and seven nonprobability samples. The first probability-based sample employed an RDD methodology while the second one consisted of a general population sample from KnowledgePanel. The seven nonprobability samples (NP1 – NP7) were secured from different online nonprobability panels that are often used as sample source for market research studies.

Results from these surveys were compared against external benchmarks across a set of 13 demographic and nine non-demographic measures. The first set was comprised of individual and household characteristics, such as marital status, household size, and home ownership status. The second set included measures related to health, drinking habits, and possession of a passport or driver's license. As depicted below, two key conclusions have emerged from this published study. First, survey estimates from nonprobability samples are subject to weak external validity even after traditional geodemographic weighting adjustments have been applied. Second, results from such surveys exhibit large volatilities compared to each other. In contrast, results from probability-based samples have higher external validity and exhibit more internal consistency.
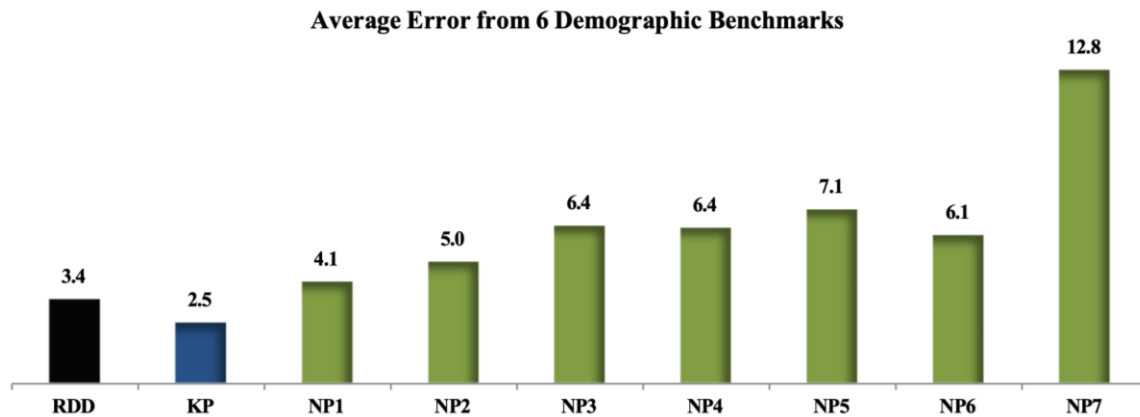
Figure 1. External and internal consistency of survey result as a function of sample type

Average Error from 13 Demographic and 9 non-Demographic Benchmarks

Perhaps equally revealing is the fact that the unweighted KnowledgePanel sample was the most representative in terms of primary demographics, even more representative than the RDD sample. The following figure shows the average error for six demographic characteristics as compared to estimates from the CPS for each sample before any geodemographic weighting adjustments were applied. This is a particularly important comparison with respect to nonprobability samples, since in most cases they are selected based on some form of demographic quota structure to ensure marginal representativeness.

1. Yeager & Krosnick, et al. "Comparing the Accuracy of Probability & Nonprobability Samples" 2011. Public Opinion Quarterly, 75(4).

Figure 2. Unweighted demographic comparisons as a function of sample type

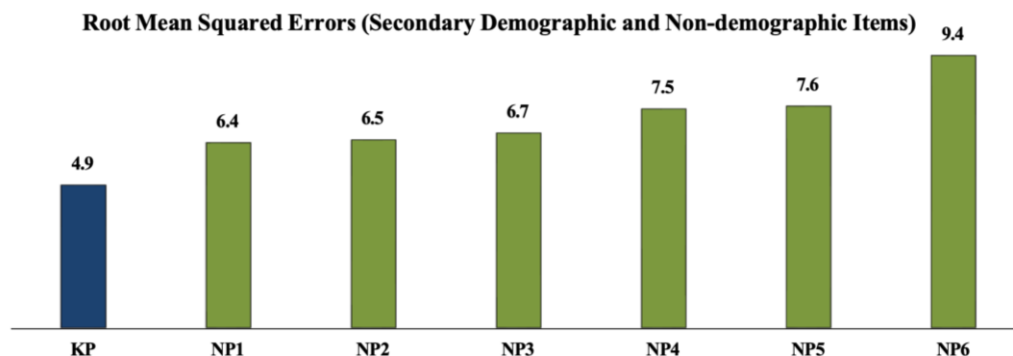**Average Error from 6 Demographic Benchmarks**

Ultimately, the authors provided the following conclusions based on comparisons of survey results secured from two probability samples (RDD and KnowledgePanel) as well as seven nonprobability samples:

- **Probability-based sample surveys** provided consistently more accurate estimates, regardless of whether the data are collected via phone or internet. Nonprobability survey estimates were always less accurate as compared to those from probability-based samples.

- **Geodemographic weighting adjustments** cannot remove the systematic biases that are inherent in survey results from nonprobability samples. This exposes a common fallacy about nonprobability samples, that *"Optimizing methods of conducting nonprobability Internet surveys can maximize their accuracy."*

The above study was replicated recently, showing similar results as summarized in the following figure[2]. Analogously, parallel surveys were conducted using a probability-based sample from KnowledgePanel along with six nonprobability samples from various opt-in panels. Once again, this research reconfirmed that survey estimates from nonprobability samples have lower external validity and exhibit notable volatilities.

Figure 3. External and internal consistency of survey result as a function of sample type

Root Mean Squared Errors (Secondary Demographic and Non-demographic Items)

2. MacInnis & Krosnick, et al. "The Accuracy of Measurements with Probability and Nonprobability Survey Samples: Replication and Extension" 2019. Public Opinion Quarterly, 82(4).

Systematic Biases of Nonprobability Samples

DiSogra et al. (2011) demonstrated that respondents from opt-in online panels often exhibit a higher tendency for early adoption of new products and services as compared to the general population. Specifically, such respondents show significantly higher levels of agreement with the following questions:[3]

- *I usually try new products before other people do*

- *I often try new brands because I like variety and get bored with the same old thing*

- *When I shop I look for what is new*

- *I like to be the first among my friends and family to try something new*

- *I like to tell others about new brands or technology*

Furthermore, Fahimi et al. (2015) have identified other behavioral measures with respect to which respondents from the two sample types differ significantly[4]. Cognizant of such observable differences between respondents from nonprobability and probability-based samples, we have developed a multivariate calibration weighting adjustment to improve the external validity of surveys that rely on blended (probability and nonprobability) samples. In addition to correcting for a higher propensity among respondents from opt-in panels for early adoption, our calibration methodology also adjusts for differences in measures related to:

- *Time spent on internet for personal use each week*

- *Time spent watching TV in a day*

- *Likelihood to express opinions online*

Bias Due to Social Desirability

There is a growing agreement among researchers that self-administered surveys are subject to considerably less social desirability bias that typically confounds results from interviewer-assisted surveys. For example, Dennis and Li (2007) examined differences observed between telephone and in-person surveys versus online administration of the same survey items. The authors concluded that there are important differences in the survey results that are attributable to the presence of an interviewer for both telephone and in-person methods of data collection.[5]

3. DiSogra C., C. Cobb, M. Dennis, E. Chan (2011). "Calibrating Non-Probability Internet Samples with Probability Samples Using Early Adopter Characteristics." Proceedings of the American Statistical Association, Section on Survey Research.

4. Fahimi, M., F. Barlas, R. Thomas, and N. Buttermore (2015). Scientific Surveys Based on Incomplete Sampling Frames and High Rates of Nonresponse. Survey Practice, Vol. 8, no 5, 2015, December Issue.

5. http://www.ipsossay.com/ganp/docs/aapor2007/Within-Panel-Mode-Experiment-GSS-AAPOR07.pdf

Direct Measurement of Non-Recruitment Bias and Survey Nonresponse Bias

One of the most thorough examinations of KnowledgePanel and its utility for public health research applications was conducted by researchers from the Boston University. This epidemiological research, which was supported by the National Institute of Alcohol and Alcoholism of NIH, involved a sample survey using the KnowledgePanel to replicate results from the gold-standard survey conducted by the Census Bureau.[6] The study compared survey estimates from KnowledgePanel to those from the National Epidemiologic Study on Alcohol and Related Conditions, which is a face-to-face, probability-based sample survey of 43,093 adults. The authors concluded that the KnowledgePanel provides a cost-effective alternative to RDD and in-person surveys for rigorous studies on alcohol-related problems that require probability-based samples.

Moreover, a nonresponse follow-up survey was conducted via telephone to interview more than 600 individuals who had refused to be recruited to KnowledgePanel. When comparing results from these nonrespondents to those panel members who had been sampled for the main survey, no significant associations were found between the two pools of respondents on questions related to risk factors for alcohol dependence.

A large study was conducted by RTI and GfK (portions of which are now part of Ipsos) to assess the impact of nonresponse bias and mode effects a few months after the September 11 tragedy. The research was designed to explore the viability of online panels as sampling frames for scientific surveys, as compared to more traditional options, such as RDD.[7] Accordingly, an experimental design was embedded in the Survey of Civic Attitudes and Behaviors After 9-11, whereby respondents from three randomly selected samples completed the survey. The first sample was comprised of active members of KnowledgePanel – half were asked to take the survey online and half by phone – and a telephone sample of individuals who had refused to join KnowledgePanel. Nonrespondents to the online survey were also contacted by telephone for refusal conversion efforts. Results were compared across four groups: active members surveyed online; active members surveyed by telephone; non-recruited members surveyed by telephone; and nonrespondents to the online survey contacted and surveyed by phone.

Various survey quality tests were conducted to measure differences that could be attributed to mode of data collection and sample type. These included sample representativeness, mode effects, sample effects, panel experience effects, primacy and recency effects, the effects of visual versus aural survey administration, and non-differentiation in survey answers.

Measurement of Self-Selection Bias

We have participated in several tests to assess self-selection bias for the KnowledgePanel members at two crucial stages: during the initial recruitment and when active members are selected to partake in client-specific surveys. A series of tests were conducted by the University of Oregon using the Heckman Selection Correction (HSC) methodology.[8] This research found that application of the HSC procedure when RDD methodology is used as reference could not support the hypothesis that attitudes toward regulatory issues are correlated with propensity to join or participate in KnowledgePanel surveys. That is, self-selection bias is not an important factor in KnowledgePanel surveys with respect to the topics tested.

6. Results of this research have been published in Alcoholism: Clinical and Experimental Research (Heeren, 2007).

7. http://www.ipsossay.com/ganp/rtimode.html

8. https://pages.uoregon.edu/cameron/papers_TAC_finalms/TreatmentJHE_online_appendix.pdf