



Description of Within-Panel Survey Sampling Methodology: The Knowledge Networks Approach

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The representativeness of KN panel surveys is attributable in part to the methodology employed by KN for drawing survey samples from the panel itself. Not covered in this paper but addressed elsewhere, the reliability and accuracy of KN panel surveys are also the result of probability-based sampling employed in the panel recruitment stage and panel management practices.¹ In this brief paper, we describe the statistical techniques used in our within-panel survey sampling methodology and, second, provide evidence of the sample representativeness that is in part a by-product of the sampling method.

First, a few words of background about KnowledgePanel®, which is the core capability of Knowledge Networks. Bringing unprecedented reliability and statistical projectability to online research, KnowledgePanel® is the only online panel that is representative of the U.S. population. By combining probability-based random-digit-dialing sampling (RDD), addressed-based sampling, and the Internet's many advantages as a research medium, KnowledgePanel® incorporates the views and opinions of all Americans. KnowledgePanel® is not susceptible to sampling errors caused by non-probabilistic methods of recruitment – that is, respondent self-selection that is the basis for the "opt-in" online panels. Thus, KnowledgePanel® provides the highest level of accuracy and representation available on the web today – a degree of reliability essential to accurate measurement of public opinion.¹

Within-Panel Survey Sampling

Once panel members are recruited and become panel members on KnowledgePanel®, they become eligible for selection for specific online surveys. In some cases, the specific survey sample represents a simple random sample from the panel. However, for most studies, the sample is drawn from eligible members using an implicitly stratified systematic sample design. Customized stratified random sampling based on pre-collected profile data (e.g., demographic, health information, political attitudes, etc.) is also conducted, as required by specific studies.

¹ Visit the "Methodological Information" page located at <http://www.knowledgenetworks.com/ganp/reviewer-info.html> for additional papers and articles on the topic.

The primary sampling rule is not to assign more than six surveys per month to members with the expectation that on average four surveys a month will be completed by a panel member. In actuality, the average adult panelist will participate in two surveys a month. In certain cases, a survey sample calls for pre-screening; that is, members are drawn from a sub-sample of the panel (e.g., females, Republicans). In such cases, care is taken to ensure that all subsequent survey samples drawn that week are selected in such a way as to result in a sample that is representative of the panel distributions.

In September 2007, Knowledge Networks was assigned a U.S. Patent (U.S. Patent No. 7,269,570) for its unique methodology for selecting online survey samples. The selection methodology, which has been used by KN since 2000, assures that KN panel samples will closely track the U.S. population.

The selection methodology was developed by KN in recognition of the practical issue that different surveys target different subpopulations. Often, only panel members with certain characteristics are selected for a survey. This can skew the remaining panel sample and affect the sample representativeness of later surveys. The patented KN methodology also was developed to attempt to adjust or correct for nonresponse and noncoverage error in the panel sample.

In our patented solution, a survey assignment method uses a weighting factor to compensate for members which are temporarily removed from a panel because of an earlier draw of sample. This weighting factor adjusts the selection probabilities of the remaining panel members. The sample is drawn using systematic probability proportionate-to size sampling (PPS) where the panel post-stratification weights will be the measure of size (MOS). If the user requirements call for independent selection by stratum, the panel weights (MOS) are adjusted as follows: (1) sum the MOS for each stratum, call this sum S_h for stratum h ; (2) consider the user-specified or system-derived target sample size for stratum h to be n_h ; (3) multiply each MOS for members in stratum h by n_h/S_h ; and (4) use an interval of $k=1$ and apply systematic PPS sampling to achieve the desired yield per stratum.

The above solution allows for representative samples to be drawn from the panel, even when earlier surveys oversampled different subpopulations. To see this more clearly, consider the following example. Suppose Study A requires a 100% oversample of Hispanics from the panel. At the beginning of the time period, each panel member will have an original selection weight making the panel selection distributions match the demographic benchmarks from the U.S. Census. After the sample draw for Study A is made, the new and temporary selection weights are calculated making the panel selection distributions match the demographics of the general public. Consequently, the sample draw for Study B will yield a representative sample. Each demographic category in the remaining panel is monitored to assure that there are enough members in each category to produce representative survey samples. The process is repeated for each study.

The implicit stratified systematic sample design has the additional benefit of correcting, in part, for nonresponse and noncoverage error introduced at the panel recruitment, connection, and panel retention stages of building and maintaining the panel. This correction is made possible by the fact that the selection weights are calculated using the latest Census Bureau (Current Population Survey) benchmarks for age, gender, race-ethnicity, and educational attainment. The samples are drawn using systematic PPS sampling where the panel post-stratification weights are the MOS. Therefore, the PPS-based samples are drawn using an MOS in an attempt to correct for under- and over-representation of certain demographic segments on the panel.

Evidence of Representativeness of KN Panel Samples

There are four main factors responsible for the representativeness of KnowledgePanel®. First, the panel sample is selected using list-assisted random digit dialing telephone and address-based sampling methodology, providing a probability-based starting sample of U.S. telephone households. Second, the panel sample weights are adjusted to U.S. Census demographic benchmarks to reduce error due to noncoverage of non-telephone households and to reduce bias due to nonresponse and other nonsampling errors. Third, as described above in the description of our within-panel sampling methodology, samples selected from the panel for individual studies are selected using probability-based methods. Appropriate sample design weights for each study are calculated based on specific design parameters. Fourth, nonresponse and post-stratification weighting adjustments are applied to the final survey data to reduce the effects of nonsampling error (variance and bias).

Below are statistical cases demonstrating the representativeness of the KN panel to support government, academic, and other scientific research.

- One of the more comprehensive tests of the KN panel was a comparison of the KN panel results to those obtained for the General Social Survey, which is the gold-standard Federally-funded survey that tracks social attitude trends in the U.S. KN staff members have co-authored papers and articles based on a series of studies based on a comparison of KN panel methodology to the in-person survey conducted by NORC. The 2007 article by Dennis and Li is available for downloading at <http://ijor.mypublicsquare.com/view/more-honest-answers>. This study examines the role of interviewer effects in accounting for differences observed between the telephone and in-person administrations of the GSS items versus online administration of the same items. In the Dennis and Li article, an experimental design is employed that provides empirical support for the pattern documented elsewhere in the literature that interviewer-administered surveys can be affected by “social desirability bias.” The authors concluded the following based on the experiment:

These observations lead us to conclude that there are important differences in the survey results that are attributable to the presence of an interviewer for the in-person and telephone modes, and to the absence of an interviewer in the web mode. The direction of the differences in the survey results, as seen in how respondents are more likely to report in the web mode that the country spends “too much” on certain problems in society, is consistent with the conclusion that web panel respondents are more honest and exhibit more candor in their responses, compared to interviewer-administered surveys. This conclusion is reinforced by the experimental design of our study, which controlled for the source of the sample. To be clear, we are not indicating that we know the “true” measure for public opinion, nor are we suggesting that the online mode survey results are closer to the “truth” about U.S. public opinion. However, we do believe that the differences we observe in the survey results are consistent with the hypothesis that online respondents feel less potent pressure to answer questions in socially desirable ways (Dennis and Li, 2007).

- Also based on the series of studies conducted comparing the KN and in-person administrations of the GSS, a study conducted by Dennis (KN) and Smith (NORC) based on 2004 collected data may be found at the following web site shown below:

http://www.publicopinionpros.com/from_field/2005/dec/smithkn.asp

This study (Smith and Dennis, 2005) showed that the KN panel results are very similar to the in-person collected survey data for the national priority survey questions. Where there are differences in the survey results, they tend to occur on more socially controversial topics where it is plausible that the differences are the result of social desirability effects that occur in the interaction between interviewers and respondents in the interviewer-administered version of the survey. We also replicated the study in 2006 with the results presented at the 2008 Joint Statistical Meetings. The 2008 paper shows support for our earlier findings, namely that the KN panel survey results are very consistent with those obtained by in-person administered GSS.

- One of the most thorough examinations of the KN panel and its usefulness for public health research was conducted by researchers from the Youth Alcohol Center at Boston University. In research supported by the National Institute of Alcohol and Alcoholism of NIH, the researchers commissioned Knowledge Networks to conduct an epidemiological survey in a replication test of the gold-standard survey conducted by the Census Bureau. The authors' methodological findings were published in Alcoholism: Clinical and Experimental Research (Heeren et al., 2007). The article compares results from the KN survey to results from the National Epidemiologic Study on Alcohol and Related Conditions (NESARC), a face-to-face probability sample survey of 43,093 adults, with a focus on associations between demographics, age of drinking onset, and alcohol dependence. In their conclusion, the authors stated that the KN panel, as it is based on probability sampling, provides an alternative to random-digit-dial telephone surveys and in-person surveys for studies of factors associated with alcohol-related problems.
- In NSF- and EPA-funded research, T. Cameron and colleagues (Cameron et al., 2005) conducted an extensive test of self-selection bias of the KN panel based on a stated preference survey on the value of human life. In a first-ever application to the KN panel, Cameron and KN employed Heckman selection correction procedure using the RDD sample frame for entire KN panel recruitment from its inception. The conclusion reached by the authors is that the KN panel, on this measure of attitudes toward regulation, does not have a statistically significant level of self-selection bias. That is to say, the hypothesis was not confirmed that attitudes towards regulatory issues are correlated with propensity to participate in a KN panel survey. This test supports the hypothesis that self-selection bias is not an important factor in KN panel surveys on the subject area of attitudes towards government regulation.

- In EPA-funded research, a second test of Heckman selection correction procedure (Viscusi et al., 2004) also did not support the hypothesis that valuations of water quality are highly correlated with the propensity to participate in a KN panel survey. The use of the Heckman selection correction procedure resulted in an adjusted estimate of -6.16%. This test supports the hypothesis that self-selection bias is not an important factor in KN panel surveys on the subject area of valuations of public goods such water quality.
- The demographic characteristics of the KnowledgePanel® sample are comparable to the demographic characteristics of high-quality RDD surveys. Krosnick and Chang (2001) found that on average, RDD and KN's respondents were different demographically with the Census estimates by 4.0 and 4.3 percentage points, respectively, compared to Harris Interactive's 8.7 percentage points difference. In this sense, the RDD and KN respondents were comparable in sample composition and twice as close to matching the general population as Harris Interactive's online respondents.²
- The validity of survey estimates based on KN-collected data have been assessed and affirmed in the area of health research by Stanford University scholars. In research funded by the U.S. Department of Veterans Affairs, Baker et al. (2003) compared KN panel data on the prevalence of health conditions and health-related behaviors to benchmarking survey data from the Centers for Disease Control and Prevention. The comparison of data was featured in a technical appendix to their article published in the Journal of the American Medical Association.³
- As shown in the table below, KnowledgePanel® tracks closely the Census benchmarks on a host of demographic criteria. A direct comparison of the KN panel to the Census benchmarks is provided in the table below. The KN panel demographics shown in the table are a fair approximation of the demographic representativeness of the samples provided to our customers for general population adult surveys.

adjustments to offset any non-response or non-coverage bias. ⁵ Estimates were calculated using CPS December 2007 microdata available at www.census.gov. are weighted using CPS final individual weights. ⁶ National housing statistics are from CPS March 2007.

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References

Baker, Laurence, Todd H. Wagner, Sara Singer, and M. Kate Bundorf. 2003. Use of the Internet and Email for Health Care Information: Results from a National Survey. *Journal of the American Medical Association*. 289:2400-2406.

Baker, Laurence C., M. Kate Bundorf, Sara Singer, and Todd H. Wagner. 2003. Validity of the Survey of Health and the Internet, and Knowledge Network's Panel and Sampling. Stanford, CA, Stanford University, 2003. Available from <http://www.knowledgenetworks.com/ganp/reviewer-info.html>.

Cameron, Trudy, J. R. Deshazo, and J.M. Dennis. 2005. [Statistical Tests of Data Quality in Contingent Valuation Survey Using Knowledge Networks Data](#). Paper presented at the 2005 Conference of the American Association for Public Opinion Research.

Dennis, J.M. and R. Li., 2007. [More Honest Answers to Surveys? A Study of Data Collection Mode Effects](#). *Interactive Marketing Research Organization's (IMRO), Journal of Online Research*. Available at <http://ijor.mypublicsquare.com/view/more-honest-answers>.

Heeren Timothy; Edwards Erika M; Dennis J Michael; Rodkin Sergei; Hingson Ralph W; Rosenbloom David L. "A Comparison of Results From an Alcohol Survey of a Prerecruited Internet Panel and the National Epidemiologic Survey on Alcohol and Related Conditions". *Alcoholism: Clinical and Experimental Research* 2008;32(2):222-9.

Krosnick, Jon A., and LinChiat Chang. 2001. A Comparison of the Random Digit Dialing Telephone Survey Methodology with Internet Survey Methodology as Implemented by Knowledge Networks and Harris Interactive. Presented at the May 2001 Conference of the American Association for Public Opinion Research.

Viscusi, W. Kip, Huber, Joel C. and Bell, Jason. 2004. The Value of Regional Water Quality Improvements. Harvard Law and Economics Discussion Paper No. 477.