

Supplemental Information

DUAL-SAMPLE SURVEY SAMPLING AND WEIGHTING METHODOLOGY

Overview of Survey Sampling and Weighting Methods Used

Participant recruitment and survey administration were conducted by NORC at the University of Chicago, an independent national survey research organization founded in 1941. As in our 2011 national pediatric FA prevalence study, a dual-sample approach was employed. This approach systematically combines survey data obtained from probability- and nonprobability-based samples via a best-in-class statistical technique for calibrating and adjusting survey estimates to offset error introduced through the nonprobability sample, improving both the reliability and validity of resulting statistical inferences.

NORC's Probability-Based AmeriSpeak Panel

To obtain our target sample size of 40 000 children, first a target of 7210 participants was initially recruited from NORC's Web-enabled AmeriSpeak panel. A survey completion rate of 51.2% was observed (7210 completions among 14 095 sampled units). The AmeriSpeak panel is a sociodemographically and geographically representative sample of US households with children recruited via a probability-based sample design by using NORC's National Frame (Supplemental Fig 4). This allows for derivation of unbiased estimates representing the full population of interest with

known margins of error accounting for the sample design, response rates, and survey weighting.

AmeriSpeak Panel Sampling Frame

To provide a nationally representative sample, AmeriSpeak leverages the NORC National Sample Frame, constructed by NORC to cover >97% of US households. The 2010 National Frame used a 2-stage probability sample design to select a representative sample of households in the United States. The first stage, the sampling unit, is a National Frame Area (NFA), which is either an entire metropolitan area (made up of 1 or more counties) or a county (some counties were combined so that each NFA contains a population of at least 10 000). The largest NFAs with a population of at least 1 543 728 (0.5% of the 2010 census US population) were selected with certainty; these areas have a high-population density and are dominated by tracts with street-style addresses. These areas contain 56% of the population within 8% of the geographic area of the United States. The remaining areas were stratified into areas where street-style addresses predominate and the remaining areas, which are less likely to have street-style addresses. The latter stratum ("rural" areas) comprises 81% of the geographic area but only 14% of the population. Within the selected NFAs, the second stage sampling unit is a segment, defined either in terms of census tracts or block groups, containing at least 300 housing units according to the 2010 census. A stratified probability sample of 1514 segments was selected with probability proportional to size.

For most of the 1514 segments, the United States Postal Service (USPS) delivery sequence file (DSF) provided >90% coverage of the segment in terms of city-style addresses that are geo-codable. For the 123 segments where the DSF provided insufficient coverage, we enhanced the DSF address list with in-person listing. The National Sample Frame contains almost 3 million households, including >80 000 rural households added through the in-person listing. AmeriSpeak incorporated address-based sampling (ABS) addresses in 2016 from the USPS DSF to assure AmeriSpeak sample representation within all US States. As of October 2016, 0.9% of AmeriSpeak panel recruited adults were sourced from the ABS (99.1% from the National Frame). Proper weights, such as those employed in the current study, allow the full use of the combined sample.

Sample Selection for AmeriSpeak Panel Recruitment

As summarized above, the 2014–2016 AmeriSpeak panel sample consists of nationally representative housing units drawn from the 2010 NORC National Sample Frame and <1% from ABS. The 2010 NORC National Sample Frame is stratified on the basis of segment (census tract or census block group) characteristics such as age and race and/or ethnicity composition of the segment, and then a stratified simple random sample of housing units is selected. Specifically, on the basis of census tract-level data, segments were classified as having a higher concentration of 18- to 24-year-old adults or not and a

higher concentration of Hispanics, non-Hispanic African Americans, and other. On the basis of these strata definitions, 6 strata (2 based on age times 3 based on race and/or ethnicity) were used to oversample housing units in segments higher in young adults and/or Hispanics and non-Hispanic African Americans. This is referred to as the initial sample or first stage of panel recruitment.

In the second stage of panel recruitment, initially sampled but nonresponding housing units are subsampled for a nonresponse follow-up (NRFU). At this stage, consumer vendor data are matched to housing units, and housing units that are flagged (based on consumer vendor data) as having a young adult or minority (Hispanic and non-Hispanic African American) are oversampled for the NRFU. Overall, ~1 in 5 initially nonresponding housing units are subsampled for NRFU. However, as mentioned previously, selection of housing units for NRFU is a stratified simple random sample based on consumer vendor data. Because of NRFU, these initially nonresponding housing units have a much higher selection probability compared with the housing units that were recruited during the first stage of panel recruitment. Note that a small fraction of initially nonresponding housing units are not eligible for NRFU because of these housing units being classified as “hard refusals” or having an appointment for a call back from NORC.

In summary, there are 2 reasons why the sampling design for AmeriSpeak panel recruitment deviates from equal probability of selection method sampling: (1) oversampling of housing units in segments with a higher concentration of young adults and minorities results in the sample selection probabilities being higher for housing units in these segments and (2) the NRFU effort results in initially nonresponding

housing units having a much higher selection probability. Furthermore, oversampling associated with NRFU results in higher selection probabilities for initially nonresponding housing units that are flagged (based on consumer vendor data) as having a young adult or minority.

AmeriSpeak Panel Recruitment Procedures

Recruitment is a 2-stage process: initial recruitment using less expensive methods and then NRFU using personal interviewers. For the initial recruitment, sample units are invited to join AmeriSpeak online by visiting the panel Web site AmeriSpeak.org or by telephone (inbound and/or outbound supported). English and Spanish language are supported for both online and telephone recruitment. Study invitations are communicated via an oversized prenotification postcard, a USPS recruitment package in a 9 × 12 inch envelope (containing a cover letter, a summary of the privacy policy, frequently asked questions, and a study brochure), 2 follow-up post cards, and also follow-up by NORC’s telephone research center for matched sample units.

The second-stage NRFU targets a stratified random subsample of the nonresponders from the initial recruitment. Stratification is based on consumer vendor data and stratification variables from the initial recruitment stage to increase sample representation of young adults, non-Hispanic African Americans, and Hispanics. Units sampled for the NRFU are sent by Federal Express a new recruitment package with an enhanced incentive offer. NORC field interviewers then make personal, face-to-face visits to the respondents’ homes to encourage participation. NORC field interviewers administer the

recruitment survey in-person using computer-assisted personal interviewing or else encourage the respondents to register at AmeriSpeak.org or call the toll-free AmeriSpeak telephone number to register.

Impact of NRFU on AmeriSpeak Panel Representativeness

The NRFU improves the representativeness of the AmeriSpeak sample with respect to certain demographic segments, including but not limited to rural and/or lower income households, cell phone-only households, persons aged 18 to 34, African Americans, Hispanics, and persons without a high school degree or who only have a high school degree (no college). Compared with panelists recruited in the initial stage, panelists recruited via the NRFU campaign are more politically conservative, are less knowledgeable about science, report less interest in current events and topics in the news (such as climate change), and are less likely to read a print newspaper.

AmeriSpeak Panel Implementation of Mixed-Mode Data Collection

Panelists may participate in 2 to 3 AmeriSpeak Panel studies per month via online (computer, tablet, or smartphones) or by computer-assisted telephone interviewing (CATI) phone. NORC maintains strict rules to limit respondent burden and reduce the risk of panel fatigue. CATI phone mode respondents represent a population currently underrepresented in Web panels that exclude non-Internet households or “net averse” persons. NORC’s telephone interviewers administer the phone mode of survey questionnaires using a data collection system supporting both the CATI phone and Web modes of data

collection, providing an integrated sample management and data collection platform. For panelists using smartphones for Web-mode AmeriSpeak surveys, the NORC survey system renders an optimized presentation of the survey questions for these mobile users. For general population client studies, ~20% of the completed interviews are completed by the telephone mode.

SSI's Nonprobability-Based Sample

An additional 33 331 participants were also recruited from an online sample of US households with children and Internet access. This second nonprobability-based sample was recruited by SSI. Nonprobability opt-in samples do not generally allow for derivation of unbiased estimates because of the lack of randomness in the opt-in sample and the high likelihood that the opt-in panel is skewed toward a nonrepresentative subset of individuals, thus leading to an increased likelihood of biased estimates from the opt-in sample. Nevertheless, SSI employs a variety of approaches to limit bias, including use of invitations of all types to recruit participants with a diversity of motivations. These include e-mail invitations, telephone alerts to mobile devices, banners, and

messaging on SSI panel community sites. The messages themselves are also varied, including invitations to give your opinion, win a prize, earn cash or prizes, or let your voice be heard. A diversity of motivation contributes to high-quality sample. Furthermore, to avoid self-selection bias, specific study details were not included in the invitation. Rather, participants were invited to "take a survey." The details are disclosed later, when the participant initiates the survey.

Complex Survey Weighting Details

Responses gleaned from the AmeriSpeak panel were used to identify and correct for sampling and nonresponse biases via calculation and application of probability sampling weights. After the nonresponse adjustment, iterative proportional fitting (also known as "raking") was conducted to rake survey weights to national US population totals associated with age, sex, education, race and/or ethnicity, and census division.

A base weight of 1 was assigned to each nonprobability sample complete, and then iterative proportional fitting was used to rake the nonprobability sample weights

to national US population totals associated with age, sex, education, race and/or ethnicity, and census division. Finally, the probability and nonprobability samples are combined through derivation of an optimal composition factor that minimizes mean square error associated with FA prevalence estimates. These adjustments account for and try to minimize any other potential bias in the opt-in sample that has not been previously accounted for.

Comparing Distributions of Unweighted AmeriSpeak Respondents, Weighted AmeriSpeak Respondents, and US Census Bureau Demographics

The below table demonstrates the high degree to which the 7210 AmeriSpeak respondents in the current study are demographically representative of the general US population. Specifically, the figure compares the demographic distributions of AmeriSpeak respondents before and after our weighting approach was implemented and then compares the weighted distributions to national demographics reported in the February 2016 Current Population Survey.

	Unweighted	Weighted	Benchmark	Difference	-10% 10%
Household income				1.6	
<\$30 000	28.1	21.7	21.7	0	
\$30 000-\$74 000	37.9	33.8	34.7	0.9	
\$75 000-\$124 999	22	26	22.8	3.2	
\$125 000+	12	18.4	20.7	2.3	
Member age				0	
18-34	22.7	30.2	30.2	0	
35-49	23.3	25	25	0	
50-64	31.6	25.9	25.9	0	
65+	22.5	19	19	0	
Race and/or ethnicity				1.1	
White	67	64.9	64.9	0	
African American	15	11.7	11.7	0	
Hispanic	9.6	15.5	15.5	0	
Asian American or Pacific Islander	2.8	3.2	6	2.8	
Others	5.7	4.8	2	2.8	
Education status				4.4	
Less than high school	4.8	6.7	12.2	5.5	
High school equivalent	16.3	24.1	29.6	5.5	
Some college	37.2	30.2	28.4	1.8	
Bachelor's degree	23.8	22	19.2	2.8	
Graduate degree	17.9	17	10.6	6.4	
Household ownership				2.4	
Owner occupied	64.4	69.4	67	2.4	
Renter occupied and/or other	35.6	30.6	33	2.4	
Children in household				0.2	
With 1+ <18 years	30	35.6	35.8	0.2	
Without children <18	70	64.4	64.2	0.2	
Marital status				0.9	
Currently married	48.7	52	52.9	0.9	
Currently single	51.3	48	47.1	0.9	
Sex				0	
Male	42.8	48.3	48.3	0	
Female	57.2	51.7	51.7	0	
Average difference				1.3	

SUPPLEMENTAL FIGURE 4

Comparing unweighted and weighted AmeriSpeak respondent demographics with 2016 US Census Bureau current population survey estimates.