



Weighting Procedures and Bias Assessment for the 2021-2022 National Health Interview Survey – Teen 18-month File

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Abstract

This report describes the weighting procedures that were used to produce the final sampling weights for the National Health Interview Survey (NHIS) – Teen 18-month file, a followback to the NHIS for Sample Children ages 12-17 whose parent or guardian had completed an NHIS interview between July 2021 to December 2022. The procedures included the use of recursive partitioning models using the R package CTREE to model parental permission and teen participation, to inform adjustments to the weights at each stage of nonresponse. CTREE was also used to generate a variable formed from the interactions of 14 predictors of teen interview completion to use as a raking variable in calibrating the weights to control totals derived from the original NHIS. A bias assessment of survey estimates based on these weights was performed. Results reveal that:

- Implementation of weighting adjustments among teen interview cases led to a 67% reduction in observed bias across 141 estimates.
- The file retains some significant biases after weighting adjustments, including an underrepresentation of teens with disability, teens with current ADD/ADHD, and teens who missed 4-9 school days due to illness or injury, and an overrepresentation of teens who have community support, wear glasses or missed 1-3 school days.
- Remaining biases after weighting adjustments are mostly small and nonsignificant, with 25 out of 141 biases > 1.5 percentage point and only 6 out of 141 biases statistically significant at the 0.05 level.

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Weighting Procedures

I. Introduction

The National Health Interview Survey (NHIS) collects data continuously and releases annual data regarding the health status and health care access and utilization of adults and children in the United States (1). Households are first rostered, and an adult is randomly selected from among all adults (ages 18 and older) in the household (known as the “Sample Adult”) and a child is randomly selected from among the children (ages 0-17) in the household, if any (known as the “Sample Child”). Separate interview modules for the Sample Adult and Sample Child are conducted, sometimes with the same respondent and sometimes with different respondents from within the household. The Sample Child’s data are not collected directly from the children themselves but are provided by proxy response, by a parent or other adult guardian in the household who is knowledgeable and responsible for the child’s health (2).

The National Health Interview Survey – Teen (NHIS – Teen) is a followback survey that collects additional data from households with Sample Children ages 12-17. In contrast to the main NHIS, which collects parent-reported data, NHIS – Teen obtains survey responses directly from the teens themselves. Prior to engaging directly with the teen, parental permission is obtained. NHIS – Teen data collection started in July 2021.

This report describes the weighting procedures for the July 2021- December 2022 NHIS – Teen 18-month file and the analysis of bias reduction due to weighting adjustments. Although this document covers the weighting methodology for the first 18 months of the NHIS – Teen sample, the NHIS – Teen will continue to follow back NHIS Sample Children through 2023. NHIS – Teen data collection lags NHIS by up to 3 months, so data collection for the 18-month sample concluded in March 2023.

II. Background

Typically, each year's NHIS public data release consists of an annual file that is created by concatenating four quarterly files, each of which is nationally representative on its own. Therefore, concatenating the quarter 3 (Q3) and quarter 4 (Q4) 2021 data with data for the four quarters of 2022 produces an 18-month file that is also nationally representative. Because each quarter represents the full population, quarterly weights must be divided by four when concatenating four quarters to produce an annual file, or divided by six when concatenating six quarters to produce an 18-month file, to ensure the sum of the weights matches that of the total population.

Thus, for the purposes of the 2021 Q3-Q4 & 2022 NHIS – Teen, the sample frame is the set of completed Sample Child interviews for Sample Children ages 12-17 from Q3 and Q4, 2021 and all of 2022. There were 4,424 Sample Children ages 12-17 in the 2021 Q3-Q4 and 2022 NHIS. A total of 4,191 were considered eligible for NHIS – Teen because the Sample Child respondent was asked for permission to invite the teen's participation (those who broke off the Sample Child interview early did not reach that question). Of those, 61.2% (n=2,563) received permission from their parents or guardians to be invited to participate in NHIS – Teen. Of those, 45.9% of teens completed an NHIS – Teen interview, resulting in an overall response rate (permission rate * participation rate) of 28.1% and a final sample size of 1,176.

For the remainder of this document, references to '2021-2022' include children sampled in Q3 and Q4 of 2021 and all of 2022, and the 18-month file is referred to as the 2021-2022 NHIS - Teen.

III. The NHIS-Teen 18-month Weight

The goal in weighting the NHIS – Teen interview cases is to make the respondents (n=1,176) represent the 2021-2022 child population ages 12-17 (i.e., the same population as represented by the 4,424 children ages 12-17 in the original Sample Child files). The sum of the

NHIS – Teen weights needs to equal the sum of the original Sample Child weights. Thus, the starting point, or base weight, is the final Sample Child weight from 2021-2022:

Step 1: Base weight

- The base weight is equal to the original Sample Child weight if the Sample Child was ages 12-17 and equals zero otherwise.

The base weight has already been adjusted for NHIS nonresponse and calibrated to the 2021-2022 population (2, 3). However, because 73.4% of the 4,424 original Sample Children ages 12-17 did not complete the NHIS – Teen interview – either because the teen did not receive permission to participate or refused to participate – the original Sample Child weight can no longer be considered representative and must be adjusted for NHIS – Teen noninterview. A 2021-2022 Sample Child is classified as an NHIS – Teen noninterview at each of the following stages:

1. Sample Child respondent refused to provide permission to invite the teen’s response (or was not asked for permission)(nonpermission);
2. Teen refusal to participate (nonresponse).

Adjustments were made to the base weights to account for each of these stages, and the resulting weights were calibrated to population control totals derived from the original survey. The specific steps are described below, while the overall scheme is presented in Flowchart 1.

Due to ineligibility, nonpermission and nonresponse, the size of the NHIS – Teen interview respondent group is approximately 26.6% that of the original 2021-2022 Sample Child file. An interview rate that low carries with it the potential for considerable bias in estimates, if estimates are related to the likelihood of gaining permission or to participation propensity. However, a major advantage of the followback design is the availability of information about nonrespondents that typically is not available when adjusting weights to account for nonresponse bias. Specifically, the complete data from the 2021 and 2022 Sample Child interviews are available for both NHIS – Teen respondents and noninterviews. Thus, it is possible to identify the specific original survey characteristics that are associated with

subsequent noninterview, and to use those covariates to form adjustment cells for weighting adjustments. This technique has been demonstrated to reduce or eliminate biases in reinterview followback samples (4-7).

Because of the very large number of potential predictors of response propensity, recursive partitioning models in the R package CTREE were used to model NHIS – Teen permission, participation (teen response), and interview propensity. Recursive partitioning models produce a set of nodes by first splitting the sample by the strongest predictor of response, and then within each of the resulting subgroups, splitting the subgroup by the strongest predictor, continuing this process until no predictor meets the significance criteria for further splitting, ending up with a tree of branches, each of which ends in a terminal node (8). The model selects the best categorizations for covariates; for example, if race/ethnicity is included in the set of covariates with 4 categories (Hispanic, non-Hispanic White, non-Hispanic Black and non-Hispanic other race) the model may split that covariate into two categories (non-Hispanic Black versus all others, e.g.) in creating the nodal splits, because that is where the differentiation on response is concentrated. The model also effectively selects the relevant interaction effects among combinations of variables (subsequent splits within subgroups are essentially interactions between the variables used to predict response propensity), without the researcher having to prespecify the interaction terms. This is particularly useful when dealing with a large set of potential covariates and little *a priori* knowledge of their interrelationships and associations with the dependent variables. The primary benefit of this approach, however, is that it results in a set of mutually exclusive and exhaustive categories (terminal nodes) which are differentiated by response propensity and defined by interactions of variables associated with key survey outcomes of interest. These terminal nodes can be used to form adjustment cells for precise weighting adjustments.

The set of 113 covariates used as potential predictors in the models was chosen to best leverage the full survey data that was available for both respondents and nonrespondents (since every case had a completed Sample Child interview). The set of covariates included demographics (age and race/ethnicity of the teen and of the original Sample Child respondent,

teen sex and nativity, number of parents in the household), household-level socioeconomic indicators (income, education, employment status, housing tenure), geographic indicators (region, metropolitan statistical area (MSA) status), household telephone status, and multiple health and healthcare measures from each of five main domains: health status, health insurance coverage, healthcare access, healthcare utilization, and stressful life events and behavioral problems. A major advantage of using sociodemographic and health covariates from the Sample Child file in the models is that they will tend to be associated with key Teen outcomes.

Missing data on covariates used as potential predictors were imputed using SAS PROC MI. Imputations were done in a single statement and sequentially, such that variables with the least amount of missing data were imputed first and variables with the most amount of missing data were imputed last.

CTREE was used to separately model permission (comparing those permitted and those not permitted, among all Sample Children ages 12-17 from the 2021-2022 Sample Child files); participation (comparing teen respondents and nonrespondents among those permitted); and overall interview (comparing teen interview respondents to all remaining Sample Children ages 12-17 among the 2021-2022 Sample Child files). The same set of potential covariates was used for models of permission, participation, and overall interview. Covariates with a bivariate association with the dependent variable (permission, participation or interview) of $p < 0.15$ screened into the model. Variables used to form terminal nodes are listed in Table 1.

Permission model—Among all eligible cases (Sample Children ages 12-17 from 2021 Q3-Q4 and 2022), some were not permitted by their parents or guardians to be invited to participate (and some were ineligible because the Sample Child respondent did not get far enough into the Sample Child interview to be asked for permission). Of 4,424, 2,560 received permission. The CTREE permission model resulted in 6 terminal nodes (ranging from 180 to 1,575 cases and with permission rates ranging from 42.8% to 67.6%). The primary split was by householder(s) expressed privacy concerns, with subsequent splits by frequency of depression; frequency of

anxiety; receipt of special education services; and number of working parents in Sample Child's family. (Unless otherwise noted, these covariates represent characteristics of the Sample Child.) The permitted cases were adjusted to account for the nonpermitted cases in step 2:

Step 2: Nonpermission adjustment

- Cases that were permitted received a ratio adjustment to the base weight: $1 /$ (the permission propensity in the CTREE permission model terminal node).

Participation model—Among permitted cases, some of the teens did not participate, i.e., were nonrespondents. Of 2,560, 1,176 participated. The CTREE participation model resulted in 13 terminal nodes (ranging from 113 to 891 cases and with participation rates ranging from 17.4% to 60.5%). The primary split was by highest education in the family with subsequent splits by year of COVID-19 vaccination; ever diagnosed with ADHD; interviewer observation of whether the sample unit has a well-tended yard or garden; race and Hispanic ethnicity of Sample Child; sex of Sample Child; family income; number of parents working full-time in Sample Child's family; number of parents working; and insurance coverage. The respondent cases were adjusted to account for the nonrespondents in step 3:

Step 3: Nonparticipation adjustment

- Cases that were NHIS – Teen interview completes received a ratio adjustment to the nonpermission-adjusted weight: $1 /$ (the participation propensity in the CTREE participation model terminal node).

Finally, the weights were calibrated to the original population control totals. Rather than raking the weights to the external population control totals that the original 2021 and 2022 Sample Child weights were raked to, internal control totals (estimated from the 2021 Q3-Q4 and 2022 Sample Child files) were used to enable the inclusion of raking dimensions which are not typically available for the population.

Overall interview model—The overall interview model uses the same dependent variable as the participation model (1,176 teens participated) but with the overall sample from the permission model (4,424 Sample Children ages 12-17 total). The overall interview CTREE model produced

12 terminal nodes (ranging from 208 to 811 cases and with interview rates ranging from 13.9% to 44.9%). The primary split was by year of COVID-19 vaccination, with subsequent splits by highest education in family; interviewer left materials (notes, brochures, letters) at sample unit; number of parents; region of residence; number of parents working fulltime in Sample Child's family; number of children in household; frequency of depression; number of parents working; race/ethnicity of Sample Child; and frequency of anxiety. The 12 nodes were used to create a single variable with 12 mutually exclusive and exhaustive categories, which was added to the raking dimensions.

Step 4: Calibration to population control totals

- For cases that were NHIS – Teen interview completes, the nonparticipation-adjusted weight was raked to internal control totals based on the 2021 Q3-Q4 and 2022 raking dimensions (age; sex; race and Hispanic ethnicity; housing tenure; region; Metropolitan Statistical Area status; family income relative to Federal Poverty Level; insurance coverage; and the 12-category variable derived from the overall interview CTREE model).

An examination of the variance inflation associated with the weighting adjustments led to an evaluation of alternatives to limit the variance inflation while maximizing bias reduction. The alternatives included capping the nonpermission and/or nonparticipation adjustments, or trimming the calibrated weights and re-raking. Capping is a process that truncates weighting adjustments beyond a certain threshold, such that if the cap were set to 3, then any adjustments larger than 3 would be reset to 3. Similarly, trimming is a process whereby extreme weights are truncated beyond a certain threshold, and the weights are re-raked such that the marginal totals are restored (essentially, the “excess weight” that is trimmed from sample cases with extremely large weights is redistributed to other sample cases with similar characteristics). Capping alternatives evaluated included 2.0, 2.25, 2.5 and 3.0, and capping options were evaluated with and without also trimming at the 99th percentile. The alternatives were evaluated based on bias reduction and reduction in average mean squared error (MSE)

and average root MSE across an array of key survey outcomes relative to the uncapped, untrimmed weight from step 4 above.

The best combination of bias reduction and noninflation of variance was achieved with the following adjustments: capping the permission adjustment at 2.25; capping the participation adjustment at 3; and trimming at the 99th percentile. The caps were implemented in steps 2 and 3 respectively, step 4 was repeated, and trimming and re-raking were added for the final adjustment:

Step 5: Trim extreme weights and re-rake

- For cases that were NHIS – Teen interview completes, the calibrated weights were trimmed at the 99th percentile and re-raked to the same control totals as in step 4.

The resulting weight is the final weight for analysis of the NHIS – Teen 18-month file: WTF18m_TEEN. Note that the raking dimensions included measures of income, health insurance coverage, health status and healthcare utilization (anxiety, depression, COVID-19 vaccination) as well as paradata from field operations (whether the interviewer left materials, interviewer observational data such as whether the yard was well-tended) in addition to the typical demographics (see Table 1). This is more specific adjustment than is typically possible and targeted directly at increasing (or decreasing) the estimated prevalence of the attributes that are under-(over)represented among the respondent cases.

Bias Assessment

IV. Introduction

While the section above described how the final weight was created, the process of determining the appropriate weighting adjustments was iterative and several weighting methods and weights were considered. The final weight was selected based on an optimization on reduction of bias, minimization of variance inflation due to weighting heterogeneity, and minimization of suppression of estimates due to unreliability. This section describes the process of evaluating the bias associated with NHIS – Teen noninterview across a set of estimates, and how well the weighting adjustments worked to reduce that bias.

V. Bias analysis for the NHIS – Teen 18-month file

One major advantage of the followback design is the ability to directly quantify noninterview bias and the reduction in that bias when the weights are adjusted. Because the goal is for the adjusted NHIS – Teen weights to represent the same population as the original Sample Child files, estimates based on the original survey are ‘gold standards’ for bias assessment. Estimates based on the NHIS – Teen interview cases (before and after weighting adjustments) can be compared with 2021-2022 estimates, and the bias resulting from completing the NHIS – Teen interviews with only a subset of the original respondents can be assessed. The analysis of noninterview bias in the NHIS – Teen interview sample is presented in Table 2 and is intended to represent the breadth of survey topical domains as well as demographic, socioeconomic and geographic characteristics (a total of 141 indicators from 83 variables).

Bias was measured directly, not estimated, as the difference in the NHIS estimates as calculated using data from the NHIS – Teen interview respondents and as calculated using data from the full set of original 2021-2022 Sample Children ages 12-17. Bias reduction was

assessed by summing the absolute values of the biases, across all the indicators, for the NHIS – Teen interview respondents weighted by the final 2021-2022 Sample Child weight (i.e., before the adjustments described above) and for the NHIS – Teen interview respondents weighted by the final adjusted 18-month weight WTF18m_TEEN. The ratio of summed bias after adjustment to summed bias before adjustment is the proportion of total bias (across 141 indicators) remaining after adjustment; its complement is the reduction in bias directly attributable to the weighting adjustments. The total bias reduction that can be directly attributed to the weighting adjustments was thus quantified at 66.6%.

Of the 141 indicators shown in Table 2, 110 improved (i.e., showed less absolute bias) while 31 worsened after weighting adjustment; that is, 110 (31) indicators show smaller (larger) differences between columns (1) and (3) than between columns (1) and (2). Of the 31 estimates that worsened, only 4 showed an increase of bias greater than one percentage point (ppt) (and none as high as 1.5 ppt): one adult working in Sample Child’s family (+1.0ppt); 4-9 school days missed due to injury/illness (+1.1ppt); any bully victimization (+1.4ppt); and Sample Child respondent was worried about paying medical bills (+1.3ppt).

For 135 indicators in Table 2, remaining bias after weighting adjustments is zero or statistically nonsignificant; only 6 show remaining biases that are significantly different than zero. (A conservative significance test was used, that adjusted the error term for the overlap of NHIS – Teen interview respondents to the 2021-2022 Sample Children, to account for the covariance due to the nonindependence of the samples; this technique is conservative in the context of testing for bias nonsignificance because it makes smaller differences appear to be statistically significant.) The six significant biases after weighting adjustments were: wears glasses or contact lenses (3.2ppt overestimated); disability (2.8ppt underestimated); current ADD/ADHD (2.3ppt underestimated); 1-3 school days due to illness or injury (4.9ppt overestimated); 4-9 school days missed (3.1ppt underestimated); and has community support (2ppt overestimated).

Although the remaining biases are not statistically significant, there remain some estimates with relatively large biases after weighting adjustments, and researchers should be aware of the specific biases noted and interpret their findings in the context of these known biases. There were 5 estimates with remaining biases of 2 ppt or larger and an additional 14 with remaining biases >1.5ppt and <2.0ppt. These include several health status indicators (ever ADD/ADHD, learning difficulty, ever learning disability, any developmental disability, and school days missed due to illness or injury); number of adults working; years at current residence; receipt of WIC and receipt of income from other sources; worried about paying medical bills; COVID-19 vaccination; and a few indicators of stressful life events (ever lived with someone who was mentally ill/depressed, difficulty controlling behavior, difficulty making friends, bully victimization).

VI. Conclusion

The richness of the data available for nonrespondents to the NHIS – Teen interview allowed for more precise adjustment to the sampling weights than is usually possible in most surveys – adjustments tailored to reduce noninterview bias in health estimates. The followback structure of the NHIS – Teen survey also allows for the actual quantification of bias. The observed bias was reduced by 67% after implementing weighting adjustments among interview cases. Thus, NHIS – Teen estimates were shown to be relatively low in bias when representing the 2021-2022 population. Relatively large and/or statistically significant biases after weighting adjustments were observed for several health status measures, number of adults working, years at current residence, receipt of WIC, other sources of income, COVID-19 vaccination, worried about paying medical bills, and a few indicators of stressful life events. Researchers should be aware of the specific biases noted and interpret their findings in the context of these known biases.

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Table 1: Variables used to define terminal nodes and adjustment cells, by adjustment

Non-permission adjustment	Nonparticipation adjustment	Overall interview raking adjustment
Householder(s) expressed privacy concerns	Highest education in family	Year of COVID-19 vaccination
Frequency of depression	Year of COVID-19 vaccination	Highest education in family
Frequency of anxiety	Ever diagnosed with ADHD	Interviewer left materials (notes, brochures, letters) at sample unit
Receives special education services	Interviewer observation of whether sample unit has a well-tended yard or garden	Number of parents
Number of working parents in Sample Child’s family	Race and Hispanic ethnicity of Sample Child	Region of residence
	Sex of Sample Child	Number of parents working full-time in Sample Child's family
	Family income relative to Federal Poverty Level	Number of children in household
	Number of parents working full-time in Sample Child's family	Frequency of depression
	Number of working parents in Sample Child’s family	Number of working parents in Sample Child’s family
	Insurance coverage	Race and Hispanic ethnicity of Sample Child
		Frequency of anxiety

Note: variables ordered by nodal split hierarchy.

Table 2: Bias analysis among NHIS – Teen cases relative to original survey estimates

<i>Indicator</i>	<i>2021 Q3-Q4 & 2022 Sample Child file (1)</i>	<i>Teens with Sample Child weight (2)</i>	<i>Teens with final Teen weight (3)</i>	<i>Remaining bias</i>
Age of the Teen	<i>Percent (standard error)</i>			<i> (3) – (1) </i>
12	16.0 (0.69)	15.1 (1.26)	16.0 (1.43)	0.00
13	15.2 (0.66)	14.5 (1.44)	15.2 (1.51)	0.00
14	18.7 (0.73)	18.6 (1.35)	18.7 (1.46)	0.00
15	17.2 (0.66)	18.7 (1.38)	17.2 (1.46)	0.00
16	16.7 (0.64)	16.9 (1.30)	16.7 (1.39)	0.00
17	16.2 (0.62)	16.3 (1.20)	16.2 (1.30)	0.00
Sex of the Teen				
Male	51.3 (0.92)	47.8 (1.71)	51.3 (1.87)	0.00
Race/ethnicity of the Teen				
Hispanic	26.4 (0.87)	21.3 (1.41)	26.4 (1.71)	0.00
Non-Hispanic Black	14.9 (0.72)	12.4 (1.21)	14.9 (1.42)	0.00
Non-Hispanic Asian	5.6 (0.33)	7.0 (0.67)	5.6 (0.58)	0.00
Non-Hispanic other	53.1 (0.97)	59.3 (1.67)	53.1 (1.77)	0.00
Age of the Sample Child respondent (SCR)				
18-34	8.5 (0.55)	5.4 (0.84)	6.5 (1.06)	1.98
35-44	43.1 (0.92)	42.8 (1.82)	44.0 (1.89)	0.82
45 and up	48.3 (0.92)	51.8 (1.81)	49.5 (1.85)	1.17
Race/ethnicity of the SCR				
Hispanic	24.2 (0.85)	18.7 (1.32)	23.8 (1.66)	0.37
Non-Hispanic White	55.3 (0.97)	62.3 (1.66)	56.0 (1.80)	0.68
Non-Hispanic Black	11.3 (0.65)	9.7 (1.10)	12.1 (1.35)	0.75
Non-Hispanic other	9.2 (0.56)	9.3 (0.92)	8.2 (0.91)	1.05
Education of the SCR				
Less than high school	11.0 (0.59)	9.1 (1.11)	11.1 (1.35)	0.16
High school/General Equivalence Degree	20.0 (0.74)	14.3 (1.21)	18.4 (1.61)	1.63
Some college	27.9 (0.82)	25.8 (1.45)	29.0 (1.64)	1.08
Bachelor's or more	41.1 (0.94)	50.7 (1.72)	41.5 (1.80)	0.38
Highest Education in the Family				
Less than high school	5.7 (0.46)	4.0 (0.76)	4.8 (0.93)	0.88
High school/General Equivalence Degree	16.3 (0.68)	11.7 (1.13)	16.6 (1.57)	0.38
Some college	28.9 (0.82)	24.8 (1.46)	29.4 (1.68)	0.54
Bachelor's or more	49.2 (0.93)	59.6 (1.71)	49.2 (1.87)	0.04
Number of Parents in Household				
One parent	36.1 (0.95)	30.1 (1.60)	37.5 (1.85)	1.42

<i>Indicator</i>	<i>2021 Q3-Q4 & 2022 Sample Child file (1)</i>	<i>Teens with Sample Child weight (2)</i>	<i>Teens with final Teen weight (3)</i>	<i>Remaining bias</i>
Nativity of the Teen				
U.S. born	94.2 (0.43)	95.0 (0.68)	94.8 (0.78)	0.63
Owning or Renting Residence				
Own/buying	68.4 (0.93)	75.1 (1.57)	68.4 (1.90)	0.00
Income Source				
Wages, salaries, commissions, bonuses, tips, or self-employment	93.1 (0.48)	94.7 (0.88)	93.4 (1.10)	0.26
Interest-bearing accounts or investments	22.9 (0.79)	29.1 (1.55)	24.2 (1.47)	1.29
Social Security or Railroad Retirement	9.7 (0.53)	8.6 (0.98)	9.4 (1.13)	0.25
Supplemental Security Income or Social Security Disability Income	7.7 (0.53)	6.3 (0.87)	7.8 (1.09)	0.09
Retirement, survivor, or disability pensions	6.3 (0.44)	6.1 (0.78)	5.7 (0.76)	0.56
Any other sources of income	17.3 (0.71)	14.3 (1.22)	15.4 (1.38)	1.82
Family income¹				
< 1.00	14.1 (0.72)	8.9 (1.13)	14.1 (1.64)	0.00
1.00 - < 2.00	22.0 (0.83)	21.5 (1.56)	22.0 (1.59)	0.00
2.00 - < 4.00	27.6 (0.78)	26.5 (1.55)	27.6 (1.65)	0.00
4.00+	36.4 (0.91)	43.2 (1.81)	36.4 (1.72)	0.00
Food security				
Food secure	90.3 (0.60)	92.3 (1.00)	90.2 (1.27)	0.16
Food insecure	5.9 (0.45)	5.2 (0.79)	7.1 (1.10)	1.16
Very food insecure	3.8 (0.40)	2.5 (0.63)	2.8 (0.69)	0.99
Couldn't afford to eat balanced meals in past 30 days	11.0 (0.64)	8.3 (1.05)	10.9 (1.37)	0.12
Food didn't last in past 30 days	12.5 (0.67)	9.8 (1.16)	12.2 (1.40)	0.30
Worry food would run out in past 30 days	14.8 (0.73)	12.2 (1.25)	15.2 (1.55)	0.39
Free or reduced meals at school past 12 months	55.6 (0.95)	52.8 (1.69)	56.8 (1.81)	1.18
Received food stamps past 12 months	21.3 (0.80)	17.0 (1.42)	22.6 (1.79)	1.34
Received WIC benefits past 12 months	5.7 (0.56)	3.9 (0.88)	4.0 (0.92)	1.69
Number of adults in child's family working				
0	6.4 (0.44)	4.5 (0.73)	5.6 (0.92)	0.78
1	33.7 (0.88)	32.4 (1.57)	35.9 (1.80)	2.28
2+	59.9 (0.92)	63.1 (1.61)	58.4 (1.82)	1.51
Number of adults in child's family working full-time				
0	11.8 (0.61)	9.3 (1.04)	11.5 (1.30)	0.35
1	43.9 (0.93)	45.9 (1.70)	45.7 (1.81)	1.72

<i>Indicator</i>	<i>2021 Q3-Q4 & 2022 Sample Child file (1)</i>	<i>Teens with Sample Child weight (2)</i>	<i>Teens with final Teen weight (3)</i>	<i>Remaining bias</i>
2+	44.3 (0.92)	44.8 (1.70)	42.9 (1.80)	1.37
Years at Current Residence				
3 years or less	33.1 (0.88)	28.4 (1.60)	30.5 (1.78)	2.52
4 to 10 years	34.6 (0.87)	36.5 (1.66)	35.7 (1.81)	1.11
10 or more years	32.4 (0.84)	35.1 (1.57)	33.8 (1.71)	1.41
Region				
Northeast	15.85 (0.68)	15.59 (1.23)	15.85 (1.47)	0.00
Midwest	20.63 (0.82)	22.94 (1.57)	20.63 (1.44)	0.00
South	39.54 (0.96)	36.55 (1.70)	39.54 (1.86)	0.00
West	23.98 (0.86)	24.91 (1.46)	23.98 (1.51)	0.00
Metropolitan Statistical Area (MSA) Status				
In an MSA	87.2 (1.25)	88.7 (1.48)	87.2 (1.66)	0.00
Telephone Status				
At least one phone that is currently working and is not a cell phone	25.2 (0.81)	29.3 (1.53)	26.2 (1.53)	0.98
Health Status				
Excellent/very good health	83.8 (0.65)	86.1 (1.23)	84.3 (1.44)	0.45
Ever had asthma	14.3 (0.61)	12.3 (1.11)	13.3 (1.27)	1.04
Still have asthma	8.0 (0.47)	6.6 (0.82)	6.9 (0.93)	1.08
Any difficulty seeing	6.9 (0.51)	6.6 (0.84)	7.6 (1.06)	0.74
Wear glasses or contact lenses	37.4 (0.90)	40.3 (1.78)	40.6 (1.85)	3.17*
Any learning difficulty	10.4 (0.58)	7.5 (0.96)	8.4 (1.12)	2.00
Any difficulty remembering	8.9 (0.54)	7.4 (0.92)	8.4 (1.15)	0.48
Disability status	14.1 (0.64)	12.1 (1.22)	11.3 (1.19)	2.81*
Ever diagnosed with Attention Deficit Disorder (ADD) or Attention-Deficit/Hyperactivity Disorder (ADHD)	14.4 (0.62)	11.4 (1.10)	12.1 (1.26)	2.24
Currently has ADD/ADHD	12.7 (0.57)	9.9 (1.00)	10.4 (1.15)	2.29*
Ever had a learning disability (LD)	9.7 (0.55)	6.6 (0.91)	8.1 (1.16)	1.64
Currently has LD	8.2 (0.52)	5.7 (0.88)	7.0 (1.12)	1.27
Currently has autism, Asperger's (ASD)	3.8 (0.34)	2.9 (0.64)	2.9 (0.63)	0.89
Currently has any other developmental disability (DD)	3.2 (0.32)	2.3 (0.61)	3.2 (0.87)	0.03
Any developmental disability (ASD/DD/ID/LD)	18.6 (0.72)	15.4 (1.30)	16.5 (1.55)	2.09
Ever had a diagnosed concussion	4.2 (0.34)	4.6 (0.72)	4.5 (0.82)	0.32
Ever had symptoms of a concussion	5.7 (0.39)	6.5 (0.83)	5.9 (0.85)	0.22

<i>Indicator</i>	<i>2021 Q3-Q4 & 2022 Sample Child file (1)</i>	<i>Teens with Sample Child weight (2)</i>	<i>Teens with final Teen weight (3)</i>	<i>Remaining bias</i>
Ever checked for a concussion	14.1 (0.57)	15.2 (1.09)	14.6 (1.18)	0.50
Life satisfaction scale				
0-6	9.0 (0.55)	8.2 (0.98)	7.7 (1.03)	1.31
7	9.6 (0.56)	11.9 (1.16)	10.2 (1.03)	0.60
8	21.7 (0.73)	21.9 (1.40)	21.0 (1.47)	0.73
9	17.7 (0.68)	19.6 (1.37)	18.9 (1.37)	1.21
10	42.1 (0.94)	38.3 (1.70)	42.3 (1.89)	0.23
Frequency of anxiety symptoms				
Never	39.3 (0.90)	32.1 (1.64)	38.5 (1.93)	0.76
A few times a year/monthly	39.8 (0.90)	45.3 (1.79)	40.8 (1.86)	1.01
Weekly/daily	20.9 (0.76)	22.6 (1.50)	20.6 (1.49)	0.25
Frequency of depression symptoms				
Never	58.9 (0.91)	53.1 (1.73)	58.2 (1.84)	0.74
A few times a year	23.9 (0.79)	27.1 (1.50)	24.4 (1.52)	0.46
Monthly/weekly/daily	17.2 (0.71)	19.8 (1.38)	17.4 (1.33)	0.27
Ever received special education services	18.1 (0.69)	15.6 (1.33)	16.9 (1.48)	1.17
Currently receive special education services	11.8 (0.59)	8.6 (0.98)	10.5 (1.26)	1.29
School days missed due to injury/illness				
0	43.1 (0.93)	42.2 (1.81)	43.0 (1.92)	0.13
1-3	25.5 (0.77)	30.8 (1.64)	30.4 (1.73)	4.91*
4-9	17.2 (0.69)	15.3 (1.25)	14.2 (1.27)	3.06*
10+	14.2 (0.66)	11.8 (1.14)	12.5 (1.32)	1.73
Stressful Life Events (SLEs)/Social Support/Behavioral Problems				
Ever lived with anyone with an alcohol/drug problem	12.4 (0.65)	10.4 (1.09)	12.0 (1.33)	0.37
Ever lived with a parent who was incarcerated	7.9 (0.54)	6.3 (0.93)	8.1 (1.20)	0.14
Ever lived with anyone mentally ill/severely depressed	12.0 (0.66)	12.7 (1.19)	13.6 (1.35)	1.60
Lifetime of being put down by adults in home	7.2 (0.50)	5.1 (0.76)	5.9 (0.95)	1.32
Ever treated/judged based on race/ethnicity	8.0 (0.51)	6.7 (0.81)	7.5 (0.98)	0.51
Ever victim of/witnessed neighborhood violence	8.1 (0.54)	7.4 (0.97)	8.0 (1.16)	0.04
Experienced two or more SLEs	86.2 (0.68)	88.7 (1.10)	86.9 (1.33)	0.67
Has community support	90.4 (0.57)	93.2 (0.86)	92.4 (1.01)	2.00*

<i>Indicator</i>	<i>2021 Q3-Q4 & 2022 Sample Child file (1)</i>	<i>Teens with Sample Child weight (2)</i>	<i>Teens with final Teen weight (3)</i>	<i>Remaining bias</i>
Always/usually get social/emotional support	77.0 (0.78)	74.0 (1.57)	76.7 (1.58)	0.25
Any difficulty with changes in routine	22.1 (0.76)	22.6 (1.47)	21.4 (1.52)	0.68
Any difficulty controlling behavior	13.2 (0.61)	11.7 (1.24)	11.7 (1.33)	1.52
Any difficulty concentrating	6.7 (0.45)	6.8 (0.93)	7.1 (1.03)	0.38
Any difficulty making friends	13.4 (0.60)	14.7 (1.16)	15.0 (1.38)	1.63
Any bully perpetration in past 12 months	8.5 (0.53)	8.6 (0.97)	8.2 (1.04)	0.30
Any bully victimization in past 12 months	76.0 (0.81)	76.3 (1.42)	77.7 (1.54)	1.71
Any cyberbully victimization in past 12 months	6.9 (0.44)	7.4 (0.85)	6.9 (0.89)	0.05
Health Care Service Use				
Saw doctor within last year	91.3 (0.52)	90.7 (1.01)	90.3 (1.14)	1.06
Child has a personal doctor	66.8 (0.97)	70.6 (1.68)	67.8 (1.90)	1.03
Child had time alone with doctor at last visit	51.8 (0.96)	51.7 (1.74)	51.5 (1.93)	0.27
Usual place of care is a doctor's office or health center	91.4 (0.54)	92.5 (0.95)	91.1 (1.20)	0.26
Telehealth visits in past 12 months	18.9 (0.68)	19.4 (1.32)	18.8 (1.43)	0.09
Urgent care visits in past 12 months				
0 visits	71.6 (0.83)	72.1 (1.54)	73.0 (1.62)	1.40
1 visit	16.1 (0.66)	16.0 (1.23)	15.3 (1.30)	0.80
2+ visits	12.2 (0.61)	11.9 (1.13)	11.6 (1.18)	0.60
Wellness visit within last year	89.5 (0.57)	90.4 (1.02)	90.5 (1.10)	1.02
ER visit(s) in past 12 months				
0 visits	87.5 (0.60)	88.9 (1.06)	87.8 (1.27)	0.36
1 visit	8.5 (0.48)	7.3 (0.85)	8.2 (1.08)	0.09
2+ visits	4.0 (0.37)	3.9 (0.69)	4.1 (0.76)	0.09
Received flu shot in past 12 months	41.5 (0.94)	45.6 (1.78)	42.1 (1.85)	0.62
Took medications for emotions in past 12 months	12.5 (0.60)	11.7 (1.09)	11.5 (1.18)	0.99
Received mental health counseling/therapy in past 12 months	17.4 (0.66)	19.5 (1.33)	18.7 (1.46)	1.28
Ever diagnosed with COVID-19	24.6 (0.77)	24.5 (1.48)	24.7 (1.65)	0.09
Received a COVID-19 vaccination				
Yes, 2021	18.0 (0.68)	22.9 (1.37)	19.9 (1.31)	1.94
No, 2021	14.7 (0.69)	10.0 (1.14)	13.5 (1.36)	1.19
Yes, 2022	40.7 (0.95)	46.7 (1.84)	39.8 (1.89)	0.93
No, 2022	26.6 (0.90)	20.4 (1.52)	26.8 (1.87)	0.19

<i>Indicator</i>	<i>2021 Q3-Q4 & 2022 Sample Child file (1)</i>	<i>Teens with Sample Child weight (2)</i>	<i>Teens with final Teen weight (3)</i>	<i>Remaining bias</i>
Prescribed medication in past 12 months	36.4 (0.87)	35.7 (1.61)	35.5 (1.75)	0.84
Health Care Access/Health Insurance Coverage				
Unable to pay medical bills in past 12 months	8.1 (0.51)	6.7 (0.94)	7.4 (1.00)	0.72
Worried about paying medical bills	31.7 (0.82)	32.1 (1.54)	33.3 (1.80)	1.65
Delayed or did not receive medical care due to cost in past 12 months	2.5 (0.29)	1.9 (0.47)	2.1 (0.60)	0.34
Health Insurance Coverage				
Private	57.8 (0.94)	63.9 (1.68)	57.8 (1.89)	0.03
Public	37.9 (0.91)	33.1 (1.64)	37.9 (1.87)	0.02
No coverage	4.3 (0.34)	3.0 (0.57)	4.3 (0.83)	0.01

¹ family income as a proportion of Federal Poverty Level, using imputed income; *Remaining bias is significantly >0 at the 0.05 level.

Source: National Health Interview Survey, 2021 & 2022; National Health Interview Survey -Teen 18-month file

Flowchart 1: NHIS-Teen 18-month weighting adjustments

