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Data and Biospecimen Collection Nonresponse Bias Analysis for Wave 1

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PATH Study Wave 1 Data and Biospecimen Collection
Nonresponse Bias Analysis

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1 Introduction

Westat has prepared this report summarizing response rates from Wave 1 of the Population Assessment of Tobacco and Health (PATH) Study and analyzing the potential for bias from non-response for Wave 1. The report is meant as a reference document for researchers using PATH Study data and includes definitions for the response rates included.

1.1 Purpose of the Non-response Bias Report

This report is organized in three sections: Section 1 reviews the Wave 1 Sample Design. Section 2 presents the Wave 1 response rates, results of a nonresponse analysis, and statistical approach for addressing nonresponse. Section 3 summarizes the findings and considers their implications.

The report covers the PATH Study's Wave 1. Response rates for Wave 1 are compared throughout this report with corresponding rates projected in the PATH Study's respective non-substantive change request to OMB for Wave 1. The comparisons refer to the best-case and worst-case scenarios for the entire sample, provided in "Attachment 22." ("Attachment 22" is part of Supporting Statement B of the PATH Study's non-substantive change request for Wave 1.)

1.2 Overview of Sample Design for Wave 1 (Baseline Wave)

The target population of the PATH Study is the civilian, non-institutionalized U.S. population (excluding Puerto Rico) 12 years of age and older. Active duty military personnel and residents of group quarters are excluded, with the exception of college students. For Wave 1, a four-stage stratified area probability sample design was used, with a two-phase design for sampling the adult cohort at the final stage. The sampling rates for adults varied by age, race, and tobacco use status. At the first stage, a stratified sample of geographical primary sampling units (PSUs) was selected, in which a PSU was a county or group of counties. For the second stage, within each selected PSU, smaller geographical segments were formed and then a sample of these segments was drawn. At the third stage, a sample of addresses was drawn from a sampling frame that consists of the residential

addresses in the U.S.; the main source of these addresses was the Postal Service (USPS) Computerized Delivery Sequence Files (CDSFs).

The fourth stage selected persons from the sampled households. A roster of all the members in the sampled household was constructed using the Household Screener. The Household Screener was used to ask one adult household member (referred to as the household informant) to list members of the household and provide demographic, and, for adults, tobacco use information about each for use in sampling three main groups of interest:

- Adults (up to two adults per household);
- Children ages 12 to 17 (referred to as "youth," generally up to two per household); and
- Children ages 9 to 11 (referred to as "shadow youth," generally up to two per household) to be enrolled in the youth cohort in later waves of the study on reaching 12 years of age.

Two-phase sampling was used for adult selection due to potential misreporting of the tobacco use status of other adult members of the household by the household informant. The Phase 1 sampling depended on the age, race, and tobacco use information provided by the household informant. The Phase 2 sampling was based on the sampled individual's self-reported age, race, and tobacco use status, obtained by interviewing the individuals sampled at Phase 1. The sampling rates for the two phases were designed to achieve large enough sample sizes for young adults (ages 18 to 24) and adult tobacco users of all ages. The tobacco use status reported by the household informant is referred to as "Phase 1 tobacco use status"; the self-reported tobacco use information obtained during Phase 2 screening is referred to as "Phase 2 tobacco use status."

Because the full sample was selected using probability sampling methods, it is representative of the U.S. civilian non-institutionalized population 12 years of age and older. The PATH Study Wave 1 sample was divided into four replicate groups, consisting of probability samples of approximately 20 percent, 30 percent, 30 percent, and 20 percent of the sampled segments, respectively, within each sampled PSU. Each separate replicate group was a probability sample from the set of segments in the frame and therefore also representative of the civilian non-institutionalized U.S. population. The replicate groups were released to the field in a sequential manner (replicate group 1 in September 2013, replicate group 2 in November 2013, replicate group 3 in February and March 2014, and replicate group 4 in May 2014).

Wave 1 2

The PATH Study completed the Wave 1 data and biospecimen collection in December 2014.[1] This section presents findings on the response rates for Wave 1, on the nonresponse analysis, and on the Study's statistical approach for addressing nonresponse.

2.1 Response Rates

This section summarizes the Wave 1 response rates for the Household Screener, Adult and Youth Extended Interviews, and biospecimen collections. The PATH Study computed the AAPOR RR3 (AAPOR, 2015) response rates for the Wave 1 data collection in accordance with the response rate guidelines provided by the OMB (Office of Management and Budget, 2006). As described below, the overall weighted response rates for the Adult and Youth Interviews were 40.0 percent and 42.3 percent, respectively, which were calculated from the response rates for specific survey components. Among those who completed the Adult Interview, the weighted response rate was 63.6 percent for providing a urine sample and 43.0 percent for providing a blood sample. The next three sections provide the details.

2.1.1 Household Screener

The Household Screener combined typical screener functions (e.g., enumerating the household, collecting demographic information about each member and some household-level data, and selecting participants for the study) with a special purpose for the PATH Study, collecting basic information on each adult's tobacco use.[2] This allowed the Study to classify the adult with sufficient validity for potential selection as a participant based on the PATH Study's sampling strata on

[1] A small number of blood collections for Wave 1 were completed in January 2015.

[2] The Household Screener collected information on adult household members' use of several different types of tobacco products. For example, it collected information on current use of products with relatively high prevalence or well-established use, such as cigarettes, cigars, and pipes; and on ever use of products with relatively low prevalence or newly emerging use at the time when Wave 1 was designed, such as electronic cigarettes or e-cigarettes.

tobacco use and demographic characteristics. Field interviewers conducted the Household Screener in person using computer-assisted personal interviewing (CAPI). The Study released 167,525 addresses; of these, 141,509 Household Screener cases were finalized (i.e., were completed or were finalized nonrespondents) during Wave 1.

Method

The AAPOR RR3 Response Rate formula calls for calculating unweighted unit response rates (RRU) as the ratio of the number of completed cases to the number of in-scope sample cases.[3] The different categories of cases that comprise the total number of in-scope cases are defined as follows:

C = number of completed cases or sufficient partials;
R = number of refused cases;
NC = number of noncontacted sample units known to be eligible;
O = number of eligible sample units not responding for reasons other than refusal;
U = number of sample units of unknown eligibility, not completed; and
e = estimated proportion of sample units of unknown eligibility that are eligible.

The unweighted unit response rate represents a composite of these components:

$$RRU=C/(C+R+NC+O+e(U))$$

In computing the response rates, refused cases, noncontacted sample units known to be eligible, and eligible sample units not responding for reasons other than refusal were combined into nonresponse cases (NR):

$$RRU=C/(C+NR+e(U))$$

Weighted response rates were also computed, where the weights compensate for unequal probabilities of selection due to planned oversampling of individuals with certain characteristics (i.e., young adults, African-American adults, and adult tobacco users). The tables contain both the weighted and unweighted response rates. Although the unweighted response rate measures operational success, the weighted response rate is needed to generalize to the population as discussed in AAPOR(2015). As a result, we largely discuss the weighted response rates below. The

[3] The sample does not have any partial completes.

weighted response rate for the household screener was 54.0 percent. Among households that were screened, the overall weighted response rate was 74.0 percent for the Adult Interview and 78.4 percent for the Youth Interview. Among those who completed the Adult Interview, the weighted response rate was 63.6 percent for providing a urine sample and 43.0 percent for providing a blood sample. The Household Screener inverse probability of selection (IPS) weights were calculated as the inverse of the selection probabilities for the sampled households. (See Section 2.2 for additional information on weighting).

Table 2-1 provides overall response rates for the Household Screener and response rates for subgroups of sampled households that belong to Census block groups with various characteristics. In addition to the overall row, the table includes rows on education, race, ethnicity, and poverty status subgroups. For example, the weighted response rate for addresses in Census block groups with "high" levels of education (>29.6% of persons ages 25 and older with Bachelor's degrees) was 48.3 percent; it was 58.0 percent for addresses in Census block groups with "low" levels of education. Comparing subgroups of responding and nonresponding households informed an assessment of the extent to which the responding addresses represented all sampled addresses and, ultimately, the population of inference. For this purpose, subgroups were defined by the characteristics of the Census block groups in which the sampled addresses were located using information from the 5-year (2009 to 2013) American Community Survey (ACS).[4] The "high" and "low" subgroup categories were defined relative to the nationwide percentage of persons having the characteristic: block groups with percentages below the national average for the characteristic were classified as low, and those with percentages above the national average were classified as high.

Results

As indicated in Table 2-1, the weighted overall response rate for the Household Screener was 54.0 percent. The weighted response rates for subgroups defined by neighborhood characteristics indicate the subgroups differed from one another by as much as 9.7 percentage points. The differences among subgroups on weighted response rates were 9.7 percentage points for education, 2.7 percentage points for race, 1.1 percentage points for ethnicity, and 7.2 percentage points for

[4] Information from the 5-year (2009 to 2013) rather than the 1-year (2013) ACS was used because 1-year ACS estimates are not provided for smaller geographies such as Census tracts or block groups. The 5-year ACS estimates, which are based on the accumulated sample from 2009 to 2013, are the only estimates from ACS that provide information at the tract level and for smaller geographies (see http://www.census.gov/acs/www/guidance_for_data_users/estimates/).

poverty status. The overall response rate for the Household Screener was lower than the projected rate of 70 percent previously presented to OMB in Attachment 22, but it exceeded the worst-case scenario response rate of 39.7 percent.

Table 2-1. PATH Study Wave 1 response rates by address characteristics: Household Screener

Neighborhood characteristic[a]	A: Completed (n)	B: Finalized nonresponse[b] (n)	C: Unknown eligible estimated to be eligible[c] (n)	Unweighted response rate for Wave 1[d] (%)	Weighted response rate for Wave 1 (%)
Overall	79,198	62,332	4,760	54.1	54.0
Education (% with Bachelor's degree)					
High > 29.6%	29,817	28,380	3,194	48.6	48.3
Low <= 29.6%	49,381	33,952	1,566	58.2	58.0
Race (% Black alone or in combination)					
High > 13.8%	20,903	15,200	1,144	56.1	56.0
Low <= 13.8%	58,295	47,132	3,616	53.5	53.3
Ethnicity (% Hispanic)					
High > 17.1%	21,596	16,522	1,186	54.9	54.8
Low <= 17.1%	57,602	45,810	3,574	53.8	53.7
Poverty Status					
High > 15.8%	31,085	20,104	1,746	58.7	58.6
Low <= 15.8%	48,113	42,228	3,014	51.5	51.4

[a] The information used to define the subgroups is from the 5-year (2009-2013) American Community Survey.

[b] Finalized nonresponse includes refused cases, uncontacted cases known to be eligible, and other eligible cases not responding for reasons other than refusal.

[c] Product of cases of unknown eligibility and estimated proportion of cases of unknown eligibility that are eligible.

[d] Response rate = A/(A+B+C).

2.1.2 Extended Interviews

The PATH Study Adult Extended Interview and Youth Extended Interview collected extensive self-report information from the adult and youth sampled persons, respectively. The Adult Extended Interview gathered information from adults (18 years old and older) about tobacco use behaviors, attitudes, knowledge, and health conditions, as well as information on demographics, environmental factors, family and peer influences, substance use, and general physical and mental health status. Field interviewers conducted the Adult Extended Interviews in person using audio computer-assisted self-interviewing (ACASI). In Wave 1, 59,088 Phase 2 Screeners were finalized, and 32,400 Adult Extended Interviews were finalized.

The Youth Interview gathered information from youth (12 to 17 years old) on topics similar to those in the Adult Extended Interview. Sampled youth were asked about their tobacco use and attitudes about tobacco; in addition, youth were asked for information on demographics, environmental factors, family and peer influences, substance use, and mental health. Field interviewers conducted the interviews in person using ACASI. The Study finalized 17,451 Youth Extended Interviews in Wave 1.

Method

Wave 1 response rates depended on completion of the Phase 1 Household Screener. For the Adult Extended Interview, the response rates were calculated as the product of (1) the Phase 2 or Individual Screener[5] response rate; and (2) the proportion of adults who completed the Adult Extended Interview among those who completed the Phase 2 Screener and were selected for the Adult Extended Interview:

$$RRU=(C_{P2}/(C_{P2}+NR_{P2}))*(C_E/(C_E+NR_E))$$

where

C_{P2} = number of completed cases for the Phase 2 Screener;
NR_{P2} = number of finalized nonresponse cases for the Phase 2 Screener;
C_E = number of completed cases or sufficient partials for the Extended Interview; and
NR_E = number of finalized nonresponse cases for the Extended Interview.

All cases were eligible.

For the Youth Extended Interview, the unweighted unit response rate is as follows:

$$RRU=C/(C+NR),$$

where

[5] Adults selected on the basis of the Phase 1 Household Screener were asked to complete the Phase 2 or Individual Screener. Those who completed the Phase 2 Screener were eligible for selection for the Adult Extended Interview, subject to further subsampling to achieve the design targets for the various age, race, and tobacco use groups. Of the adults who completed the Phase 2 Screener and were selected for the Adult Extended Interview, approximately 99.7 percent completed the Adult Extended Interview.

C = number of completed cases for the Extended Interview; and
NR = number of finalized nonresponse cases for the Extended Interview.

Again, all cases were eligible.

The adult and youth response rates were weighted to compensate for unequal probabilities of selection due to planned oversampling of individuals with certain characteristics. Person-level weights were computed as the product of the Household Screener IPS weights and individual IPS weights, which were calculated as the inverse of the selection probabilities for all persons sampled (responding and nonresponding persons). (See Section 2.2 for additional information on weighting.)

Tables 2-2 and 2-3 provide response rates for the Adult Extended Interview and Youth Extended Interview, respectively. In addition to the overall row, these tables include rows on age, sex, race, and ethnicity subgroups; Table 2-2 also includes a row on tobacco use status.[6] Information from the Household Screener is used to define the demographic characteristics for the responding and nonresponding persons. Among adults for whom the Household Screener had missing values for information on tobacco use status, sampling at Phase 1 was based on the selection probabilities used for tobacco users, shown in the "sampled as user" row of Table 2-2. Adults for whom the Household Screener had missing values for other characteristics were excluded from the response rate calculation for the particular characteristic.

Results

For the **Adult Extended Interview**, the weighted overall response rate was 74.0 percent. (See Table 2-2.) This overall rate was lower than the projected rate of 85 percent, but it exceeded the worst-case scenario response rate of 58.1 percent previously provided to OMB in Attachment 22.

The weighted response rates for tobacco use status and demographic subgroups indicate the subgroups differed from one another by as much as 10.5 percentage points. As noted, information on the tobacco use status and demographic characteristics of eligible participants used in this table

[6] Tobacco use status is based on information obtained in the Household Screener.

Table 2-2. PATH Study Wave 1 response rates by respondent characteristics: Adult Extended Interview

Characteristic[a]	Phase 2 Screener		Adult Extended Interview		Unweighted response rate for Wave 1[c] (%)	Weighted response rate for Wave 1 (%)
	A: P2 Screener, completed (n)	B: P2 Screener, finalized nonresponse[b] (n)	C: Adult Extended, completed (n)	D: Adult Extended, finalized nonresponse[b] (n)		
Overall	44,303	14,785	32,320	80	74.8	74.0
Tobacco use status						
Sampled as user	23,859	7,299	21,362	55	76.4	76.4
Sampled as non-user	20,444	7,486	10,958	25	73.0	72.7
Age[d]						
18-24	11,679	3,732	9,059	16	75.6	75.1
25-44	14,663	4,593	11,266	18	76.0	75.4
45-64	12,503	4,229	8,761	30	74.5	73.8
65+	5,207	2,002	3,088	16	71.9	71.7
Sex[d]						
Male	21,546	8,166	16,321	50	72.3	71.4
Female	22,743	6,574	15,996	30	77.4	76.5
Race[d]						
White alone	32,222	11,085	23,645	53	74.2	73.8
Black alone or in combination	7,602	1,884	5,532	15	79.9	79.2
Other	3,344	1,363	2,452	8	70.8	68.7
Ethnicity[d]						
Hispanic	7,818	2,270	5,400	18	77.2	76.0
Non-Hispanic	36,430	12,433	26,891	62	74.4	73.7

[a] The characteristics are as sampled. That is, information on the characteristics was collected in the Household Screener.

[b] Finalized nonresponse includes refused cases and other eligible cases not responding for reasons other than refusal.

[c] Response rate = (A/(A+B))*(C/(C+D)).

[d] The sum of counts for this category for Adult Extended, Completed (Column C) do not sum to the overall total due to missing values. The number of missing cases is 146 for age, 3 for sex, 691 for race, and 29 for ethnicity.

was gathered in the Household Screener. The differences among subgroups on weighted response rates were 3.7 percentage points for tobacco use status, 3.7 percentage points for age, 5.1 percentage points for sex, 10.5 percentage point for race, and 2.3 percentage points for ethnicity.

For the **Youth Extended Interview**, the weighted overall response rate was 78.4 percent. (See Table 2-3.) This overall rate was higher than the projected rate of 75 percent in Attachment 22. A worst-case scenario response rate was not specified for the Youth Interview.

Table 2-3. PATH Study Wave 1 response rates by respondent characteristics: Youth Interview

Characteristic[a]	A: Completed (n)	B: Finalized nonresponse[b] (n)	Unweighted response rate for Wave 1[c] (%)	Weighted response rate for Wave 1 (%)
Overall	13,651	3,800	78.2	78.4
Age[d]				
12-14	6,925	1,775	79.6	79.8
15-17	6,583	1,974	76.9	77.2
Sex[d]				
Male	6,988	1,960	78.1	78.2
Female	6,659	1,838	78.4	78.6
Race[d]				
White alone	9,623	2,705	78.1	78.2
Black alone or in combination	2,511	573	81.4	81.6
Other	1,079	408	72.6	72.7
Ethnicity[d]				
Hispanic	3,757	848	81.6	82.0
Non-Hispanic	9,873	2,947	77.0	77.1

[a] The characteristics are as sampled. That is, information on the characteristics was collected in the Household Screener.

[b] Finalized nonresponse includes refused cases and other eligible cases not responding for reasons other than refusal.

[c] Response rate = A/(A+B).

[d] The sum of counts for this category for Completed (Column A) do not sum to the overall total due to missing values. The number of missing cases is 143 for age, 4 for sex, 438 for race, and 21 for ethnicity.

The findings on the weighted response rates for demographic subgroups indicate the subgroups differed from one another by as much as 8.9 percentage points. Information on the demographic characteristics of eligible participants used in this table was gathered in the Household Screener. Differences among subgroups on weighted response rates were 2.6 percentage points for age, 0.4 percentage points for sex, 8.9 percentage point for race, and 4.9 percentage points for ethnicity.

2.1.3 Biospecimen Collections

This section is on the method and response rates for the collection of urine and blood samples from adults who completed Adult Extended Interviews.[7] Biospecimens are intended to provide a basis for the assessment of between-person differences and within-person changes in markers of tobacco exposure, and to detect and compare indicators of conditions and related disease processes associated with the use of tobacco products. Field interviewers collected the urine samples; on separate visits, phlebotomists collected the blood samples. The 32,320 adults who completed the Adult Extended Interview were eligible to provide biospecimens.

Method

Table 2-4 provides overall unweighted and weighted response rates for the biospecimen collections, and response rates for tobacco use status and demographic subgroups. The response rates are conditional on a completed Household Screener and a completed Adult Extended Interview. The response rates were calculated using the following formula:

RRU = Number of samples collected/number of Adult Extended Interviews completed

This is the same formula used to compute the projected biospecimen response rates presented in Attachment 22 for Wave 1. The denominator for the rate, the 32,320 adults who completed the Adult Extended Interview, is the same for both of the biospecimen response rates.

In addition to the overall row, the table includes rows on tobacco use status, age, sex, race, and ethnicity subgroups. Information from the Adult Extended Interview is used to define the tobacco use status and demographic characteristics for the responding and nonresponding adults. Adults with missing values for such characteristics were excluded from the response rate calculation for that characteristic.

[7] Buccal cells were collected from adult participants for approximately 8 of the 15 months of Wave 1 (through May 18, 2014, when OMB approved a change request to discontinue the collection of this biospecimen). The PATH Study did not resume buccal cell collection in Wave 2; in addition, the Study has no plans to resume this collection in Wave 3.

Table 2-4. PATH Study Wave 1 response rates by respondent characteristics: Biospecimen collections

Characteristic[a]	A: Adult Extended Interviews completed (n)	Biospecimen					
		Urine			Blood		
		B: Collected (n)	Unweighted response rate for Wave 1[c]	Weighted response rate for Wave 1	B: Collected (n)	Unweighted response rate for Wave 1[c]	Weighted response rate for Wave 1
Overall	32,320	21,801	67.5	63.6	14,520	44.9	43.0
Tobacco use status[b]							
Sampled as user	23,084	16,116	69.8	68.9	10,764	46.6	46.4
Sampled as non-user	9,234	5,683	61.5	60.3	3,754	40.7	40.8
Age[b]							
18-24	9,110	6,457	70.9	69.0	3,884	42.6	41.4
25-44	11,269	7,742	68.7	65.8	5,004	44.4	41.0
45-64	8,818	5,725	64.9	62.2	4,191	47.5	45.4
65+	3,110	1,873	60.2	57.5	1,438	46.2	43.9
Sex[b]							
Male	16,309	10,763	66.0	62.4	6,920	42.4	41.1
Female	15,982	11,025	69.0	64.6	7,594	47.5	44.6
Race[b]							
White alone	23,242	15,531	66.8	63.2	10,637	45.8	44.2
Black alone or in combination	5,538	3,911	70.6	66.6	2,381	43.0	40.3
Other	2,726	1,801	66.1	61.4	1,152	42.3	38.4
Ethnicity[b]							
Hispanic	5,536	3,870	69.9	66.4	2,452	44.3	40.5
Non-Hispanic	26,288	17,633	67.1	63.1	11,885	45.2	43.7

[a] The characteristics are as reported in the Adult Extended Interview.

[b] The sum of counts for this category for Urine (Column B) do not sum to the overall total due to missing values. The number of missing cases is 2 for tobacco use, 4 for age, 13 for sex, 558 for race, and 298 for ethnicity. Also, the sum of counts for this category for Blood (Column B) do not sum to the overall total due to missing values. The number of missing cases is 2 for tobacco use, 3 for age, 6 for sex, 350 for race, and 183 for ethnicity.

[c] Response rate = B/A.

Results

The weighted response rate for **urine** was 63.6 percent; the projected response rate was 80 percent, and the worst-case response rate was 49 percent. The differential weighted response rate for subgroups of respondents ranges from 2.2 percentage points for sex to 11.5 percentage points for age.

The weighted response rate for **blood** was 43.0 percent; the projected response rate was 65 percent, and the worst-case response rate was 39 percent. The differential weighted response rate for subgroups of respondents ranges from 3.2 percentage points for ethnicity to 5.8 percentage points for race. The response rate for blood collection was lower than projected, but it exceeds the worst-case scenario in Attachment 22.

2.2 Nonresponse Bias Analysis

This nonresponse bias analysis investigates possible differences between estimates calculated from Wave 1 of the PATH Study and independent estimates of those quantities from other surveys and censuses. By so doing, the Study can assess the extent to which differential nonresponse among population subgroups may affect estimates. Results are presented on the characteristics of respondents to the Household Screener, Adult Extended Interview, and Youth Interview, and on adults from whom biospecimens were collected for the PATH Study. The analysis of nonresponse bias is based on the full set of Wave 1 data.

2.2.1 Method

The method used in the PATH Study to assess potential nonresponse bias begins by comparing estimates of demographic counts from the Wave 1 sample[8] with corresponding estimates from the American Community Survey (ACS). The 1-year (2013) ACS estimates, calculated from the 2013

[8] The full Wave 1 sample was used for the analyses in this section; however, the weights used for this report are preliminary. Estimates based on final releases of the Wave 1 PATH Study data may differ slightly from those in this report.

ACS Public Use Microdata Sample (PUMS),[9] were used for comparison purposes. The estimates calculated from the ACS PUMS excluded institutional group quarters and persons in noninstitutional group quarters who were not college students. These exclusions correspond to exclusions from the target population for the PATH Study.

The PATH Study measures a range of tobacco use behaviors; many of these variables are not available in other studies. However, responses to the PATH Study questions on current cigarette smoking can be compared with estimates from other surveys that ask about cigarette smoking behavior. The following surveys were used for comparison: the Tobacco Use Supplement to the Current Population Survey, 2010-2011 (TUS-CPS); the National Health and Nutrition Examination Survey, 2011-2012 (NHANES); the National Health Interview Survey, 2013 (NHIS); the National Survey on Drug Use and Health, 2013 (NSDUH); and the National Youth Tobacco Survey, 2012 (NYTS). Appendix A describes the questions used to define current smoking on each of these surveys as well as the PATH Study, and outlines differences in target populations among these surveys and the PATH Study.

The PATH Study oversamples young adults, African-American adults, and adult tobacco users. Consequently, unweighted estimates of population quantities would be expected to be biased. In this section, the inverse-probability-of-selection (IPS) weights, calculated using the probabilities of selection, are used to estimate population quantities. Without nonresponse, estimates calculated using the IPS weights would be expected to be within sampling error of the population counts.

The IPS weights were calculated in two stages. First, the household-level IPS weights (HHIPSWT) were calculated for all households sampled (responding households and nonresponding households) as the inverse of the selection probability:

$$HHIPSWT_{ijk} = \frac{1}{P_{ijk}}.$$

[9] The ACS PUMS files provide a probability sample of individual records from the full ACS (United States Census Bureau, 2015), allowing data users to create custom tables that are not available through pre-tabulated ACS data products. Using the PUMS files allowed comparison estimates to be calculated that corresponded to the target population for the PATH Study.

Here, P_{ijk} is the probability that household k in segment j of PSU i is selected to be in the sample. Addresses were sampled directly from the USPS CDSF, so that P_{ijk} is the product of the PSU, the segment-within-PSU, and the address-within-segment selection probabilities.

For nonresponse bias assessment purposes, the person-level IPS weights were computed using HHIPSWT. For youth ages 12-17, these were calculated as

$$YIPSWT_{ijkl} = HHIPSWT_{ijk} \times \frac{1}{\text{Probability youth } l \text{ in household } (ijk) \text{selected for sample}}.$$

Most selected households had fewer than 3 youths, who were then selected with certainty, so that for most households, the youth IPS weight (YIPSWT) is the same as the household-level IPS weight.

Adults were selected with different probabilities according to their age, race, and tobacco use status. The adult IPS weights (AIPSWT) were calculated as

$$AIPSWT_{ijkl} = HHIPSWT_{ijk} \times \frac{1}{\text{Probability adult } l \text{ in household } (ijk) \text{selected for sample}}.$$

Sampling of adults occurred in two phases. Phase 1 selected adults based on responses to the Household Screener. The probability that adult l in the household was selected in Phase 1 was a function of the number of adults in the household and of the ages, races, and tobacco use statuses reported for those adults by the informant completing the Household Screener. Adults sampled at Phase 1 were individually asked questions about their age, race, and tobacco use as part of the Phase 2 Screener, and were subsampled for continuation into the Adult Extended Interview on the basis of their responses to those questions. The probability in the formula for AIPSWT is the product of the first-phase and second-phase selection probabilities.

Note that no nonresponse adjustments were performed for the calculation of IPS weights. The weights HHIPSWT, YIPSWT, and AIPSWT were used for all calculations employing IPS weights reported in Section 2.2.2. In the tables presented in Section 2.2.2, the unweighted counts include categories for missing values. Estimates of percentages calculated using weights, however, exclude respondents with missing values for that item. The estimates calculated from other surveys that are used for comparison purposes also exclude missing values, except where noted.

Point estimates for the PATH Study were calculated using HHIPSWT for household estimates, AIPSWT for adult estimates, and YIPSWT for youth estimates. Replicate weights, used to calculate variances, account for the complex sampling features of stratification and clustering. Precisions for the estimates are reported using 95 percent confidence intervals. Estimates from TUS-CPS, NHANES, NHIS, NSDUH, and NYTS[10] also have sampling error, so 95 percent confidence intervals are reported for the estimates from those surveys as well.[11] SAS software version 9.3 (SAS Institute, 2011) was used to calculate all point estimates and confidence intervals.

2.2.2 Results

The first set of tables provides estimates derived from the Household Screener. Demographic characteristics were estimated using the information on the roster of household members provided by the household respondent. The household-level IPS weight HHIPSWT was used in Tables 2-5 through 2-9 to evaluate potential nonresponse bias. If nonresponse is not associated with demographic characteristics, then the percentages calculated using HHIPSWT would be expected to be close to those from the ACS. Note that the ACS estimates are for calendar year 2013 while the PATH Study Wave 1 data were collected between September, 2013 and December, 2014. There is therefore the possibility that differences for some rapidly changing characteristics may reflect the later data collection for the PATH Study. There are other measurement differences that could be associated with each study that could affect differences between estimates. For example, if the ACS allows proxy respondents and the PATH Study does not, then this measurement difference could result in some estimates differing.

[10] Estimates from TUS-CPS were obtained from US Department of Commerce (2012) published tables. Estimates from NHANES, NHIS, and NYTS were calculated from their respective public use files (CDC, 2014a, 2014b, 2015b). Estimates from NSDUH were obtained from CBHSQ (2014), SAMHSA (2014), and from the Survey Documentation and Analysis system at http://www.icpsr.umich.edu/cgi-bin/SDA/SAMHDA/hsda?samhda+35509-0001.

[11] If the confidence interval from the PATH Study estimate does not overlap with the confidence interval from the comparison study, then the results are significantly different at the 0.05 significance level. Schenker and Gentleman (2001) show that this results in a conservative test. Confidence intervals are not reported for the ACS results because they are based on such large sample sizes that the sampling error is negligible. For comparison with ACS results, the PATH Study estimate significantly differs from the ACS estimate at the 0.05 significance level if the ACS percentage is outside of the PATH Study confidence interval. In general, if a 95 percent confidence interval for percentage of adults who are current smokers from the PATH Study includes a fixed value X, then a hypothesis test of the null hypothesis that the percentage of adults who are current smokers equals X would have p-value > 0.05 and therefore the difference between the PATH Study estimate and the estimate from the external survey is not statistically significant.

Table 2-5 presents unweighted counts and estimated population percentages for adults in the four race/age domains used for sampling adults within households based on the enumeration of adults from the Household Screener. Comparisons of the PATH Study estimates to the ACS estimates for these four domains are shown in Table 2-5. The IPS-weighted estimates of percentages in the Black 18-24 and Black 25+ domains are similar to the 1-year 2013 ACS estimates. The PATH Study estimate of the percentage in the non-Black 18-24 domain is 1.3 percentage points higher than the corresponding ACS estimate, and the PATH Study estimate in the non-Black 25+ domain is 2.6 percentage points lower than the ACS estimate.

Table 2-5. Race by age distribution, based on the household enumeration: IPS weights

Race and age classification	Unweighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Percentage from ACS PUMS
Black* 18-24	3,669	2.3%	[2.0%, 2.6%]	2.0%
Black* 25+	17,934	11.4%	[9.9%, 12.9%]	10.5%
Non-Black 18-24	18,058	11.4%	[10.8%, 12.0%]	10.1%
Non-Black 25+	116,957	74.9%	[73.3%, 76.5%]	77.5%
Missing age or race	4,003			
Total	**160,621**	**100.0%**		**100.0%**

*Black alone or in combination with other race(s).

Table 2-6 compares the sex of the adults enumerated on the PATH Study household rosters with the 1-year 2013 ACS distribution. The confidence intervals from the PATH Study include the ACS percentages, indicating no evidence of nonresponse bias with respect to sex.

Table 2-6. Distribution of male and female adults listed in the household enumeration: IPS weights

Sex	Unweighted count	Weighted percentage for adults, using household IPS weights	Confidence interval using household IPS weights	Percentage from ACS PUMS
Male	77,088	48.0%	[47.8%, 48.2%]	48.1%
Female	83,500	52.0%	[51.8%, 52.2%]	51.9%
Missing	33			
Total	**160,621**	**100.0%**		**100.0%**

Table 2-7 compares the distribution of household size for the responding households with corresponding estimates from the 1-year 2013 ACS. Compared with the ACS, the PATH Study estimates fewer single- and two-person households and more households with at least three persons. The PATH Study also estimates a lower percentage of single-adult households (Table 2-8) and, probably related to this pattern, a slightly higher estimated percentage of households with youth ages

12-17 than found in the ACS (Table 2-9).[12] If no further weighting adjustments were performed then to the extent that household size is associated with the PATH Study's outcomes, those outcomes may be affected by nonresponse bias. However, this concern is addressed by the weighting adjustments and results described in Section 2.3.

Table 2-7. Distribution of household size based on households responding to the Household Screener: IPS weights

Number of persons in household	Unweighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Percentage from ACS PUMS
1	17,822	22.7%	[22.1%, 23.4%]	27.7%
2	26,098	33.0%	[32.5%, 33.5%]	33.7%
3	13,503	17.0%	[16.7%, 17.3%]	15.7%
4	11,720	14.7%	[14.3%, 15.1%]	13.0%
5+	10,055	12.6%	[12.0%, 13.2%]	9.9%
Total	**79,198**	**100.0%**		**100.0%**

Table 2-8. Distribution of number of adults based on households responding to the Household Screener: IPS weights

Number of adults in household	Unweighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Percentage from ACS PUMS
0-1*	21,869	27.8%	[27.1%, 28.5%]	33.3%
2	40,961	51.7%	[51.2%, 52.2%]	50.7%
3+	16,368	20.5%	[19.8%, 21.1%]	16.0%
Total	**79,198**	**100.0%**		**100.0%**

*A small number of households contain only emancipated youth and hence contribute to the zero part of this category.

Table 2-9. Distribution of number of youth ages 12-17 based on households responding to the Household Screener: IPS weights

Number of youth ages 12-17 in household	Unweighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Percentage from ACS PUMS
0	65,661	83.0%	[82.4%, 83.5%]	84.4%
1	9,569	12.0%	[11.7%, 12.4%]	11.1%
2+	3,968	5.0%	[4.7%, 5.2%]	4.5%
Total	**79,198**	**100.0%**		**100.0%**

[12] Surveys commonly achieve a slightly lower percentage of one-person households because they have fewer members available for contact. See Brault (2013), who found a similar pattern in the CPS ASEC content test.

Tables 2-10 and 2-11 are based on adults in the Wave 1 sample responding to the Adult Extended Interview. As noted above, the PATH Study oversamples young adults, African-American adults, and adult tobacco users, so estimates calculated without weights will not accord with population estimates. The IPS-weighted estimates are calculated using the adult weight AIPSWT; if the PATH Study had full response, it would be expected that the IPS-weighted estimates would be close to the corresponding population quantities. Table 2-10 presents the estimated race, ethnicity, and sex/age distributions from adults in the Wave 1 sample responding to the Adult Extended Interview.

Additional columns in the table present the weighted distributions, using weight AIPSWT, for the adults from whom urine and/or blood specimens were collected.

When using unweighted counts, males comprise more than 50 percent of the 32,320 PATH Study respondents in Wave 1. By contrast, the IPS-weighted estimated percent of males in the population at Wave 1 is significantly lower than the ACS estimate. This is also true for the subset of respondents to the Adult Extended Interview who provided blood and/or urine specimens. Age group comparisons show that the IPS-weighted estimates of the percent of adults who are ages 18-44 based on the PATH Study respondents to the Adult Extended Interview, and based on the adults providing urine specimens, are significantly higher than the ACS estimate. The nonresponse-adjusted weights in Section 2.3, which calibrate to age groups and to sex, correct for these discrepancies for the Adult Extended Interview respondents.

Table 2-10 shows that the estimated percentages in different race and ethnicity groups, calculated using adults responding to the Adult Extended Interview, or using those who provide blood specimens, are similar to the 1-year 2013 ACS estimates of those quantities, with the exceptions that persons in the "other race" category are underrepresented among respondents to the Adult Extended Interview and persons providing urine and/or blood specimens, with corresponding slight overrepresentation of Whites among the persons providing blood specimens and of Blacks among the persons providing urine specimens. Hispanics are slightly overrepresented among respondents to the Adult Extended Interview and persons providing urine specimens.

Table 2-10. Demographic distributions based on adults responding to the Adult Extended Interview, and based on adults providing urine or blood specimens: IPS weights

	Adult respondents to Adult Extended Interview			Adults from whom urine specimen is collected			Adults from whom blood specimen is collected			ACS PUMS
	Un-weighted count	Weighted percentage, using adult IPS weights	Confidence interval using adult IPS weights	Un-weighted count	Weighted percentage, using adult IPS weights	Confidence interval using adult IPS weights	Un-weighted count	Weighted percentage, using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage
Sex										
Male	16,309	45.7%	[44.9%, 46.6%]	10,763	44.9%	[43.9%, 45.9%]	6,920	43.7%	[42.6%, 44.8%]	48.1%
Female	15,982	54.3%	[53.4%, 55.1%]	11,025	55.1%	[54.1%, 56.1%]	7,594	56.3%	[55.2%, 57.4%]	51.9%
Missing	29			13			6			
Total	**32,320**	**100.0%**		**21,801**	**100.0%**		**14,520**	**100.0%**		**100.0%**
Age group										
18-24	9,110	13.8%	[13.2%, 14.4%]	6,457	14.9%	[14.2%, 15.6%]	3,884	13.3%	[12.5%, 14.0%]	13.0%
25-44	11,280	35.8%	[35.0%, 36.6%]	7,744	37.0%	[36.0%, 38.0%]	5,005	34.1%	[33.1%, 35.2%]	34.3%
45-64	8,818	33.7%	[32.8%, 34.5%]	5,725	33.0%	[32.0%, 33.9%]	4,191	35.6%	[34.4%, 36.7%]	34.5%
65+	3,110	16.7%	[16.0%, 17.4%]	1,873	15.1%	[14.3%, 15.9%]	1,438	17.1%	[16.1%, 18.1%]	18.2%
Missing	2			2			2			
Total	**32,320**	**100.0%**		**21,801**	**100.0%**		**14,520**	**100.0%**		**100.0%**
Race										
Black alone or in combination	5,538	14.1%	[12.1%, 16.1%]	3,911	14.8%	[12.6%, 17.0%]	2,381	13.2%	[11.2%, 15.2%]	12.5%
White alone	23,242	77.4%	[75.1%, 79.7%]	15,531	77.0%	[74.6%, 79.4%]	10,637	79.3%	[77.1%, 81.5%]	75.7%
Other	2,726	8.5%	[7.5%, 9.5%]	1,801	8.2%	[7.2%, 9.2%]	1,152	7.5%	[6.7%, 8.4%]	11.8%
Missing	814			558			350			
Total	**32,320**	**100.0%**		**21,801**	**100.0%**		**14,520**	**100.0%**		**100.0%**
Ethnicity										
Hispanic	5,536	17.8%	[15.3%, 20.3%]	3,870	18.6%	[16.0%, 21.2%]	2,452	16.7%	[13.9%, 19.5%]	15.0%
Non-Hispanic	26,288	82.2%	[79.7%, 84.7%]	17,633	81.4%	[78.8%, 84.0%]	11,885	83.3%	[80.5%, 86.1%]	85.0%
Missing	496			298			183			
Total	**32,320**	**100.0%**		**21,801**	**100.0%**		**14,520**	**100.0%**		**100.0%**

Table 2-11. Comparison of education level and health insurance status based on adults completing the Adult Extended Interview and based on adults providing urine or blood specimens: IPS weights

	Adult respondents to Adult Extended Interview			Adults from whom urine specimen collected			Adults from whom blood specimen collected			ACS PUMS
	Un-weighted count	Weighted percentage, using adult IPS weights	Confidence interval using adult IPS weights	Un-weighted count	Weighted percentage, using adult IPS weights	Confidence interval using adult IPS weights	Un-weighted count	Weighted percentage, using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage
Education										
18-24										
< HS, HS or GED	4,465	49.9%	[48.1%, 51.7%]	3,234	50.4%	[48.3%, 52.5%]	1,948	50.2%	[47.7%, 52.6%]	43.6%
> HS	4,593	50.1%	[48.3%, 51.9%]	3,197	49.6%	[47.5%, 51.7%]	1,928	49.8%	[47.4%, 52.3%]	56.4%
Subtotal	**9,058**	**100.0%**		**6,431**	**100.0%**		**3,876**	**100.0%**		**100.0%**
25+										
< HS or GED	4,769	18.0%	[16.9%, 19.1%]	3,425	19.3%	[18.1%, 20.6%]	2,405	19.0%	[17.6%, 20.5%]	16.9%
HS	4,763	20.0%	[19.1%, 21.0%]	3,106	19.8%	[18.6%, 20.9%]	2,071	19.0%	[17.7%, 20.2%]	23.8%
Some college, no degree	7,650	31.3%	[30.2%, 32.3%]	5,238	32.4%	[31.3%, 33.4%]	3,721	33.4%	[31.9%, 34.9%]	29.2%
Bachelor degree	3,642	18.2%	[17.1%, 19.2%]	2,139	16.7%	[15.6%, 17.9%]	1,454	16.7%	[15.3%, 18.1%]	18.7%
> Bachelor degree	2,228	12.5%	[11.5%, 13.5%]	1,369	11.8%	[10.8%, 12.8%]	956	11.9%	[10.8%, 13.1%]	11.3%
Subtotal	**23,052**	**100.0%**		**15,277**	**100.0%**		**10,607**	**100.0%**		**100.0%**
Missing	210			93			37			
Total	**32,320**			**21,799**			**14,520**			
Health insurance										
Yes	25,760	84.4%	[83.5%, 85.2%]	17,306	83.9%	[83.0%, 84.8%]	11,686	85.0%	[84.0%, 86.0%]	83.3%
No	6,156	15.6%	[14.8%, 16.5%]	4,335	16.1%	[15.2%, 17.0%]	2,758	15.0%	[14.0%, 16.0%]	16.7%
Missing	404			160			76			
Total	**32,320**	**100.0%**		**21,799**	**100.0%**		**14,520**	**100.0%**		**100.0%**

Table 2-11 compares Adult Extended Interview respondents and those from whom biospecimens were collected to the ACS with respect to education level and presence of health insurance. The estimated distributions of educational level from adults responding to the Adult Extended Interview and from adults providing biospecimens differ from that in the ACS. For adults responding to the interview and for adults providing biospecimens, the estimated percentages of 18-24 year-olds with at least some college are lower than the ACS; among older adults, the estimated percentages of persons with a high school degree are lower than the ACS and the estimated percentages of persons with some college but no degree are higher than the ACS. In addition, among the adults providing biospecimens the estimated percentages of adults ages 25+ with less than a high school education are higher than the ACS and the estimated percentages of adults ages 25+ with a bachelor's degree are lower than the ACS. Education level has been shown to be associated with tobacco use status (Agaku et al., 2014); the nonresponse-adjusted weights described in Section 2.3 adjust for educational attainment. Estimates of percentage of adults with health insurance based on respondents to the Adult Extended Interview and on those who provided blood samples are higher than the corresponding estimate from the 2013 ACS, although no significant difference was found between the estimate from the PATH Study respondents providing urine samples and the estimate from the ACS. It should be noted, however, that the ACS estimates do not account for persons who obtained insurance in 2014 under the Affordable Care Act.

Table 2-12 presents the estimates of prevalence of current cigarette smoking[13] for adults based on the Adult Extended Interview, for the adult population as a whole and for subgroups. These estimates are accompanied by 95 percent confidence intervals for the percentage of current cigarette smokers for the PATH Study estimates. The last five columns are the estimates of smoking prevalence from TUS-CPS, NHIS, NHANES, and NSDUH, respectively, along with 95 percent confidence intervals from those surveys. Note that these estimates exclude responses of "don't know" and missing values.

The estimates of current smoking prevalence differ substantially from survey to survey. Many potential reasons can explain these disparities, including that each survey has sampling error. Beyond that, however, the surveys differ in question order, context, design, mode of administration, and year of most recent data collection.

[13] For the PATH Study, following common practice for tobacco surveys, a current smoker is someone who (1) has smoked at least 100 cigarettes in his or her lifetime and (2) currently smokes every day or some days. The questions used to define current smoking for each survey are provided in Appendix A.

In general, the TUS-CPS estimates of smoking prevalence are lower than estimates from the other surveys, including the PATH Study. This may be related to the proxy responses used in the TUS-CPS. The rotation group structure of the TUS-CPS may result in underestimates of smoking prevalence, as smokers are more likely to drop out over the course of the panel survey (Song, 2013).

The PATH Study and NSDUH both use ACASI administration for the tobacco use questions so that the interviewer does not see responses to the questions. By contrast, TUS-CPS, NHIS, and NHANES have direct questioning by an interviewer: NHIS and NHANES are conducted in person, and TUS-CPS is conducted in person and by telephone. The contexts and purposes of these surveys also differ: CPS is a general survey on unemployment, NHIS and NHANES are general health surveys, and NSDUH is a cross-sectional survey on substance use (including tobacco use) and health, including mental health. Unlike the cross-sectional prevalence surveys, the PATH Study is designed for research purposes and uses a longitudinal cohort design to assess within-person change and between-person differences in tobacco use behaviors and health over time. Other differences among the questions used in the instruments of these different studies are outlined in Appendix A.

Table 2-12 indicates the IPS-weighted estimates of current smoking from the PATH Study are most similar to estimates from NHIS and NHANES. All of the 95 percent confidence intervals for percent of current cigarette smokers constructed from the PATH Study overlap with the confidence intervals for NHIS, NHANES, or both. Estimates from TUS-CPS tend to be below the estimates from the PATH Study, NHIS, and NHANES; estimates from NSDUH tend to be above the estimates from the PATH Study, NHIS, and NHANES. No evidence was found to indicate nonresponse bias in the PATH Study with respect to cigarette smoking behavior among adults, because the PATH Study's estimates are all within the range of estimates from comparable surveys.

Table 2-13 gives estimates of current cigarette smoking for the adults from whom urine and/or blood specimens were collected. The IPS-weighted estimates of smoking are higher for adults who contributed biospecimens. However, the confidence intervals for smoking among adults providing biospecimens are in line with the estimates from NSDUH and NHANES.

Results in Tables 2-10 through 2-13 are based on adults in the full Wave 1 sample responding to the Adult Extended Interview. Similar analyses were performed for the youth respondents. The demographic estimates are given in Table 2-14 and estimates of two measures of cigarette smoking commonly applied to youth are given in Table 2-15.

Table 2-12. Current cigarette smoking based on adults responding to the Adult Extended Interview: IPS weights

	Sample size	PATH Study: Unweighted percentage	PATH Study: Weighted percentage, using adult IPS weights [95% confidence interval]	Percentage from 2010-2011 TUS-CPS [95% confidence interval]	Percentage from 2013 NHIS [95% confidence interval]	Percentage from 2011-2012 NHANES* [95% confidence interval]	Percentage from 2013 NSDUH, original definition** [95% confidence interval]	Percentage from 2013 NSDUH, modified definition [95% confidence interval]
Current smoker	32,245	35.4%	18.6% [17.7%, 19.4%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]
Current smoker, male	16,265	36.8%	21.2% [20.3%, 22.2%]	18.0% [17.7%, 18.4%]	20.5% [19.5%, 21.4%]	23.9% [20.7%, 27.1%]	25.6% [25.1%, 26.1%]	23.8% [22.7%, 24.9%]
Current smoker, female	15,952	33.9%	16.4% [15.4%, 17.3%]	14.2% [13.9%, 14.5%]	15.3% [14.6%, 16.0%]	16.0% [13.5%, 18.5%]	20.4% [20.0%, 20.8%]	18.4% [17.6%, 19.3%]
Current smoker, age 18-24	9,099	27.2%	20.1% [18.8%, 21.5%]	17.1% [16.4%, 17.8%]	18.7% [16.8%, 20.5%]	20.4%*** [13.7%, 27.1%]	NA****	NA
Current smoker, age 25-44	11,260	41.2%	22.9% [21.8%, 24.1%]	17.9% [17.5%, 18.4%]	20.1% [19.1%, 21.1%]	23.3% [20.0%, 26.7%]	NA	NA
Current smoker, age 45-64	8,784	40.6%	18.7% [17.7%, 19.8%]	17.8% [17.4%, 18.2%]	20.0% [19.0%, 20.8%]	21.3% [18.3%, 24.2%]	NA	NA
Current smoker, age 65+	3,100	23.3%	7.7% [7.0%, 8.4%]	7.8% [7.5%, 8.2%]	8.8% [8.0%, 9.6%]	9.2% [6.7%, 11.7%]	NA	NA
Current smoker, Hispanic	5,519	26.3%	13.4% [12.6%, 14.2%]	10.9% [10.4%, 11.5%]	12.1% [11.0%, 13.2%]	16.6% [13.7%, 19.5%]	18.9% [18.1%, 19.7%]	15.2% [13.8%, 16.7%]
Current smoker, white non-Hispanic	19,268	38.8%	19.6% [18.5%, 20.7%]	17.5% [17.2%, 17.8%]	19.4% [18.5%, 20.2%]	20.2% [17.0%, 23.3%]	24.1% [23.7%, 24.5%]	22.8% [21.9%, 23.6%]
Current smoker, other non-Hispanic	6,904	33.3%	20.4% [19.3%, 21.5%]	NA	16.7% [15.6%, 17.8%]	20.8% [16.6%, 24.9%]	21.8% [20.2%, 23.4%]	19.6% [18.1%, 21.2%]
Current every-day smoker	32,245	28.0%	14.8% [13.9%, 15.6%]	12.7% [12.4%, 12.9%]	13.7% [13.1%, 14.2%]	16.4% [14.3%, 18.4%]	NA	NA
Current some-days smoker	32,245	7.4%	3.8% [3.6%, 4.1%]	3.4% [3.3%, 3.5%]	4.1% [3.8%, 4.4%]	3.4% [2.7%, 4.1%]	NA	NA

*The smoking questions asked in NHANES for adults ages 20 and older differ from the questions asked for persons ages 12-19. The modes of administration also differ for the two age groups. The NHANES estimates presented in this table are for adults ages 20 and older.

**NSDUH's definition of a current cigarette smoker is someone who has smoked part or all of a cigarette in the past 30 days, which is more expansive than the definition used in the other surveys. However, NSDUH contains questions on lifetime smoking and current smoking. The modified definition uses these questions to construct a measure of "current smoking" that is comparable to that of the other surveys (Ryan et al., 2012). The construction of this variable is described in Appendix A. The estimates and confidence intervals for the NSDUH "original definition" (except for the "current smoker, other non-Hispanic" estimate) are from the published tables (SAMHSA, 2014); the estimates and confidence intervals for the "modified definition" are calculated from the public use data set. The estimate of current smoking for the "other non-Hispanic" group was not available from the published tables and it was also calculated from the public use data set.

***The estimate is for adults 20-24 years old.

****Detailed age information was not available in the public use file for NSDUH 2013.

Table 2-13. Current cigarette smoking based on adults providing biospecimens in Wave 1: IPS weights

	Sample size	PATH Study: Weighted cigarette smoking prevalence, using adult IPS weights [95% confidence interval]	Percentage from 2010-2011 TUS-CPS [95% confidence interval]	Percentage from 2013 NHIS [95% confidence interval]	Percentage from 2011-2012 NHANES [95% confidence interval]	Percentage from 2013 NSDUH, original definition* [95% confidence interval]	Percentage from 2013 NSDUH, modified definition [95% confidence interval]
Adult respondent to Adult Extended Interview	32,245	18.6% [17.7%, 19.4%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]
Adults providing urine	21,757	20.9% [20.0%, 21.9%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]
Adults providing blood	14,493	21.6% [20.5%, 22.7%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]

*NSDUH's definition of a current cigarette smoker is someone who has smoked part or all of a cigarette in the past 30 days. However, NSDUH contains questions on lifetime smoking and current smoking. The modified definition uses these questions to construct a measure of "current smoking" that is comparable to that of the other surveys (Ryan et al., 2012). The construction of this variable is described in Appendix A.

Table 2-14 shows that the IPS-weighted estimates of percentages of youth who are male/female and ages 12-13/14-17 are not significantly different from the 1-year 2013 ACS percentages. The PATH Study estimate of the percent of youth who are Hispanic, however, is approximately 6 percentage points higher than the corresponding estimate from ACS, indicating that Hispanic youth were more likely to respond to the PATH Study survey.

Table 2-14. Demographic distributions based on youth ages 12-17 who completed the Youth Interview: IPS weights

	Unweighted count	Weighted percentage, using youth IPS weights	Confidence interval using youth IPS weights	Percentage from ACS PUMS
Sex				
Male	6,971	51.2%	[50.3%, 52.1%]	51.3%
Female	6,641	48.8%	[47.9%, 49.7%]	48.7%
Missing	39			
Total	**13,651**	**100.0%**		**100.0%**
Age group				
12-13	4,684	34.3%	[33.4%, 35.2%]	33.7%
14-17	8,965	65.7%	[64.8%, 66.6%]	66.3%
Missing	2			
Total	**13,651**	**100.0%**		**100.0%**
Race/ethnicity				
Hispanic	3,880	28.6%	[25.2%, 32.1%]	22.3%
Non-Hispanic white alone	6,616	48.4%	[45.1%, 51.7%]	54.5%
Non-Hispanic other	3,135	23.0%	[20.5%, 25.5%]	23.2%
Missing	20			
Total	**13,651**	**100.0%**		**100.0%**

Table 2-15 provides estimates from the PATH Study for two common measures of cigarette smoking prevalence among youth respondents compared with estimates from NHANES, NSDUH, and NYTS.[14] Different measures of smoking are used in this report for youth than for adults. The primary measure of cigarette smoking among youth in this report is whether the youth has ever tried smoking a cigarette, even one or two puffs (see Appendix A). Another measure is current smoking, defined as having smoked at all in the past 30 days. Both are shown in Table 2-15.

[14] TUS-CPS does not interview persons younger than 18 about tobacco use.

Table 2-15. Cigarette smoking* based on youth ages 12-17 who completed the Youth Interview: IPS weights

	Sample size	PATH Study: Unweighted percentage	PATH Study: Weighted percentage, using youth IPS weights [95% confidence interval]	Percentage from 2011-2012 NHANES [95% confidence interval]	Percentage from 2013 NSDUH [95% confidence interval]	Percentage from 2012 NYTS [95% confidence interval]
Ever tried cigarette smoking, even one or two puffs	13,631	13.5%	13.5% [12.6%, 14.5%]	20.5% [17.5%, 23.6%]	15.7% [15.4%, 16.0%]	25.6% [23.6%, 27.6%]
Ever tried smoking, male	6,959	13.9%	14.0% [13.0%, 15.1%]	21.1% [15.9%, 26.3%]	16.3% [15.8%, 16.8%]	27.2% [25.0%, 29.3%]
Ever tried smoking, female	6,634	13.1%	13.1% [12.0%, 14.2%]	20.0% [14.6%, 25.5%]	15.1% [14.6%, 15.6%]	24.0% [21.8%, 26.2%]
Ever tried smoking, age 12-13	4,675	4.6%	4.6% [3.9%, 5.4%]	5.6% [1.9%, 9.4%]	4.0% [3.7%, 4.3%]	11.8% [10.2%, 13.4%]
Ever tried smoking, age 14-17	8,954	18.1%	18.2% [17.1%, 19.4%]	28.3% [23.5%, 33.0%]	21.0% [20.0%, 22.0%]	32.5% [30.0%, 34.9%]
Have smoked in past 30 days	13,613	4.7%	4.7% [4.2%, 5.1%]	6.9% [4.0%, 9.8%]	5.6% [5.4%, 5.8%]	8.7% [7.7%, 9.8%]

*Defined as ever tried a cigarette, even one or two puffs. For comparison, an additional measure of current smoking commonly applied to youth (having smoked at all in the past 30 days) is also included in this table.

Differences in target populations and administration among the youth surveys might lead to differences in their estimates. In addition, the youth survey estimates have sampling error, as demonstrated by the confidence intervals about the estimates from the comparison surveys. Questions and their orderings also differ among the surveys, as described in Appendix A, as do the modes of administration. The PATH Study, NHANES, and NSDUH use ACASI for the questions about tobacco use by youth, and these are administered individually in a household or mobile examination center setting. The NYTS is a pencil-and-paper survey administered in the classroom. Currivan et al. (2004) found that even when telephone ACASI was used, estimates of youth smoking prevalence were lower for a telephone survey of youth smoking than for a school-based survey of the same population (see also Fowler and Stringfellow, 2001, for a discussion of higher smoking rates in school-based surveys). In addition, school-based surveys often include students who are older than 17, which is the upper age limit for youth in the PATH Study.

The PATH Study's estimates of youth smoking are lower than comparable estimates from NHANES and NSDUH. Part of this difference may be sampling error and part may be attributable to differences among the survey wordings and administrations. Moreover, the comparison surveys are from different time periods. According to SAMHSA (2013, 2014), cigarette smoking among teens is dropping (from 2012 to 2013, the percentage of youth who had ever tried smoking dropped by 0.8 percentage points among 12-13 year olds, 1.6 percentage points among 14-15 year olds, and 2.7 percentage points among 16-17 year olds, with similar decreases from 2011 to 2012). The lower percentages found by the PATH Study may reflect, in part, a continuation of this trend. However, some of the differences among the estimates of youth smoking prevalence may be attributable to nonresponse bias or measurement error on the part of one or more of the surveys.

2.3 Statistical Approach for Addressing Nonresponse

2.3.1 Interviews

Differential weight adjustments at the household and person level were performed to address nonresponse (United Nations 2005, chapter 6; Särndal and Lundström, 2005; Brick, 2013). The weight adjustments calibrated estimates of demographic characteristics from the PATH Study so that they accorded with independent estimates of those characteristics from the 2010 Decennial Census and the 2013 American Community Survey (ACS; the ACS estimates are considered to be highly accurate because of its large sample size and high response rates). At the household level,

information obtained from the 2010 Census on the percentage of population that is Hispanic, the percentage of population that is black, the percentage of housing units that are owner-occupied, and other information related to demographics and income was used to form weighting classes, and the weights of respondents in those classes were inflated so that those households also represented the nonrespondents in those cells. After this adjustment, the household weights were calibrated to agree with the ACS with respect to the number of adults and non-adults in the household, correcting for the higher nonresponse among single-person households to the PATH Study. At the person level, the weights were adjusted so that estimates of race, age group, sex, and educational attainment agreed with the ACS. These variables were chosen for adjustment because of their availability for almost all respondents and their relationship to response propensity from tree-based models (Bethlehem, 2002; Toth and Phipps, 2014).

Household Nonresponse-Adjusted Weights

Household IPS weights were computed for all sampled addresses in Wave 1. The IPS weights for responding households were adjusted to compensate for the estimated number of nonresponding households that were eligible for the PATH Study but did not complete the Household Screener. An eligibility adjustment was computed separately for each census region. Further adjustments were made within weighting classes based on information available for both responding and nonresponding households, namely the segments and blocks in which they are located. Census 2010 data were used to form weighting classes according to the percentage of occupied housing units, the percentage of population that is Black,[15] the percentage of population that is Hispanic, and other information related to demographics and income. Census region and the urbanicity of the PSU and segment were also used when forming the weighting classes.

Within a weighting class, the IPS weights for the responding households were inflated proportionately to produce the same sum as the sum of the combined IPS weights of the responding and nonresponding households. The nonresponse-adjusted household weight is

$$HHNRWT_{ijk} = HHIPSWT_{ijk} \times \frac{\text{sum of HHIPSWT for eligible sampled households in weighting class}}{\text{sum of HHIPSWT for responding households in weighting class}}$$

[15] Black is defined as Black alone, or in combination with other races.

The nonresponse-adjusted weights were raked to the 1-year 2013 ACS household counts by census region and household composition. Household composition was defined by the number of non-adult persons in the household (0, 1, or 2+) and the number of adult household members (1, 2, 3+). For raking purposes, the household composition was imputed for households missing this information using logical imputation.[16] The final raked household weight is

$$HHRKWT_{ijk} = HHNRWT_{ijk} \times (\text{raking adjustment}).$$

Person Nonresponse-Adjusted Weights

The raked household-level weight was used as the foundation for calculating the nonresponse-adjusted person-level weights, for both youth and adults. The initial person-level nonresponse-adjusted weight was computed as the product of the Household Screener raked weight HHRKWT and the reciprocal of the within-household probability of selection for person l within household k of PSU i and segment j, as shown in the following formulas:

$$AP1BWT_{ijkl} = HHRKWT_{ijk} \times \frac{1}{\text{Probability adult } l \text{ selected at Phase 1 from household } (ijk)},$$

$$YBWT_{ijkl} = HHRKWT_{ijk} \times \frac{1}{\text{Probability youth } l \text{ selected from household } (ijk)}.$$

The probability of selection differed for adults and youth, as described in Section 2.2.1. Although shadow youth were not interviewed at Wave 1, a base weight was calculated for the shadow youth to serve as their base weight once they age up to the youth cohort:

$$SYBWT_{ijkl} = HHRKWT_{ijk} \times \frac{1}{\text{Probability shadow youth } l \text{ selected from household } (ijk)}.$$

Similar to the adjustment for Household Screener nonresponse, a nonresponse adjustment was performed to account for nonrespondents to the Youth Extended Interview. The weighting classes were formed using information similar to that used for the household-level nonresponse adjustment, and other variables from the Household Screener: age and sex of the household informant; count of

[16] See Lohr (2010) for a brief description of raking and imputation methods.

adults in the household (0, 1, 2, 3, 4, 5+); and age, sex, and race/ethnicity of the youth. The youth weight adjusted for nonresponse is

$$YNRWT_{ijkl} = YBWT_{ijkl} \times \frac{\text{sum of YBWT for eligible sampled youth in weighting class}}{\text{sum of YBWT for responding youth in weighting class}}$$

For youth, the nonresponse-adjusted weights were raked to population totals from the 1-year 2013 ACS, using census region, age, race/ethnicity, and sex as raking variables. If variables used for nonresponse and/or raking adjustments were missing, they were imputed from the Household Screener or by logical or hot-deck imputation. After raking, the final weights for youth are denoted as YRKWT and were computed as

$$YRKWT_{ijkl} = YNRWT_{ijkl} \times (\text{raking adjustment}).$$

A similar procedure was used to create raked weights SYRKWT for shadow youth at Wave 1.

Final weights for adults were computed in three steps. First, a nonresponse adjustment was performed using the information described above for the household-level nonresponse adjustment (with the exception of the segment urbanicity) and other variables from the Household Screener: count of adults in the household (0, 1, 2, 3, 4, 5+); and age, race/ethnicity, sex, and tobacco use status of the adult. The resulting adult weight for respondents to the Phase 2 Screener after adjusting for nonresponse between Phases 1 and 2 of the adult sampling procedure is

$$AP1NRWT_{ijkl} = AP1BWT_{ijkl} \times \frac{\text{sum of AP1BWT for adults sampled at Phase 1 in weighting class}}{\text{sum of AP1BWT for adults responding to Phase 2 Screener in weighting class}}.$$

Second, the probability of selection at Phase 2 was used to calculate the Phase 2 weight:

$$AP2WT_{ijkl} = AP1NRWT_{ijkl} \times \frac{1}{\text{Probability adult } l \text{ from household } (ijk) \text{ selected at Phase 2}}.$$

Finally, the Phase 2 adult weights were raked to independent population totals based on data from the 1-year 2013 ACS. The raking was done using combinations of census region, age, race/ethnicity, sex, and educational attainment. If variables used for nonresponse and/or raking adjustments were missing, they were imputed from the Household Screener or by logical or hot-deck imputation. The final raked weight is

$$ARKWT_{ijkl} = AP2WT_{ijkl} \times (\text{raking adjustment}).$$

Estimates calculated using the raked weights for variables of interest in the PATH Study are shown in Tables 2-16 through 2-27, which repeat the analyses used for Tables 2-5 through 2-12, 2-14, and 2-15. The estimates calculated using IPS weights are retained in these tables to facilitate comparisons of the estimates obtained using the two sets of weights. Confidence intervals are given for each of the IPS-weighted and raked-weighted estimates in each of Tables 2-16 through 2-27. The confidence intervals reported for the IPS-weighted estimates are the same as those given in the corresponding tables in Section 2.2.

Table 2-16. Race by age distribution, based on household enumeration

Race and age classification	Unweighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Weighted percentage, using household raked weights	Confidence interval using household raked weights	Percentage from ACS PUMS
Black* 18-24	3,669	2.3%	[2.0%, 2.6%]	2.0%	[1.8%, 2.3%]	2.0%
Black* 25+	17,934	11.4%	[9.9%, 12.9%]	11.1%	[9.7%, 12.5%]	10.5%
Non-Black 18-24	18,058	11.4%	[10.8%, 12.0%]	10.2%	[9.7%, 10.7%]	10.1%
Non-Black 25+	116,957	74.9%	[73.3%, 76.5%]	76.7%	[75.2%, 78.1%]	77.5%
Missing age or race	4,003					
Total	**160,621**	**100.0%**		**100.0%**		**100.0%**

*Black alone or in combination with other race(s).

Table 2-17. Distribution of male and female adults listed in the household enumeration

Sex	Unweighted count	Weighted percentage for adults, using household IPS weights	Confidence interval using household IPS weights	Weighted percentage for adults, using household raked weights	Confidence interval using household raked weights	Percentage from ACS PUMS
Male	77,088	48.0%	[47.8%, 48.2%]	47.7%	[47.5%, 47.9%]	48.1%
Female	83,500	52.0%	[51.8%, 52.2%]	52.3%	[52.1%, 52.5%]	51.9%
Missing	33					
Total	**160,621**	**100.0%**		**100.0%**		**100.0%**

The household raked weight HHRKWT adjusts the weights so that they agree with the 1-year 2013 ACS household counts by region and household size. They would therefore not necessarily match closely person-level percentages of specific demographic groups the ACS values. Tables 2-16 and 2-17 compare the estimated percentage of adults in the PATH Study household rosters to the ACS values for each race/age and sex group using the raked weights. The estimated percentages using the

raked weights are not significantly different from the ACS values for race/age, although they are significantly different from the ACS values for sex. Table 2-21 indicates that using the raked adult weights produces distributions for race/age and sex that are practically identical to those from the ACS.

Tables 2-18 through 2-20 provide estimated distributions for household size and numbers of adults and youth per household, respectively; as expected, the raked weights align the estimated percentages with the 1-year 2013 ACS values. Confidence intervals shown in Tables 2-18 and 2-19 for the estimates computed with the raked weights are narrow because the raking constrains the estimates to accord with the ACS on the raking dimensions.

Table 2-18. Distribution of household size based on households responding to the Household Screener

Number of persons in household	Un-weighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Weighted percentage, using household raked weights	Confidence interval using household raked weights	Percentage from ACS PUMS
1	17,822	22.7%	[22.1%, 23.4%]	27.7%	[27.7%, 27.7%]	27.7%
2	26,098	33.0%	[32.5%, 33.5%]	33.7%	[33.7%, 33.7%]	33.7%
3	13,503	17.0%	[16.7%, 17.3%]	15.2%	[15.1%, 15.4%]	15.7%
4	11,720	14.7%	[14.3%, 15.1%]	12.9%	[12.7%, 13.1%]	13.0%
5+	10,055	12.6%	[12.0%, 13.2%]	10.5%	[10.3%, 10.6%]	9.9%
Total	**79,198**	**100.0%**		**100.0%**		**100.0%**

Table 2-19. Distribution of number of adults based on households responding to the Household Screener

Number of adults in household	Un-weighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Weighted percentage, using household raked weights	Confidence interval using household raked weights	Percentage from ACS PUMS
0-1*	21,869	27.8%	[27.1%, 28.5%]	33.3%	[33.3%, 33.4%]	33.3%
2	40,961	51.7%	[51.2%, 52.2%]	50.7%	[50.7%, 50.7%]	50.7%
3+	16,368	20.5%	[19.8%, 21.1%]	16.0%	[15.9%, 16.0%]	16.0%
Total	**79,198**	**100.0%**		**100.0%**		**100.0%**

*A small number of households contain only emancipated youth and hence contribute to the zero part of this category.

Table 2-20. Distribution of number of youth ages 12-17 based on households responding to the Household Screener

Number of youth ages 12-17 in household	Un-weighted count	Weighted percentage, using household IPS weights	Confidence interval using household IPS weights	Weighted percentage, using household raked weights	Confidence interval using household raked weights	Percentage from ACS PUMS
0	65,661	83.0%	[82.4%, 83.5%]	84.6%	[84.3%, 84.8%]	84.4%
1	9,569	12.0%	[11.7%, 12.4%]	11.0%	[10.8%, 11.2%]	11.1%
2+	3,968	5.0%	[4.7%, 5.2%]	4.4%	[4.3%, 4.6%]	4.5%
Total	**79,198**	**100.0%**		**100.0%**		**100.0%**

Tables 2-21 and 2-22 present estimates of demographic characteristics, education, and health insurance based on adult respondents in Wave 1, using the adult raked weight ARKWT. Raking adjusted the weights to match ACS totals for combinations of sex, age, race, ethnicity, and education categories. Raking increased the estimated percentage of adults with health insurance, however, as noted in Section 2.2, the ACS estimates for the percentage of adults with health insurance were based on data collected before the launch of the Affordable Care Act.

Estimates of smoking prevalence in Table 2-23 using the raked weight ARKWT are similar to the estimates using the IPS weight AIPSWT; both are in the range of values obtained by other surveys. The use of raked weights resulted in a slight decrease in estimated smoking prevalence for females and non-white non-Hispanics.

Tables 2-24 and 2-25 examine the effect of the raked weight YRKWT on estimates calculated for youth. As expected, raking corrects for the overrepresentation of Hispanics among youth in Wave 1. The IPS-weighted estimates for youth age and sex agree with the 1-year 2013 ACS estimates. Consequently, raking had little if any effect on estimates of these characteristics. Cigarette smoking prevalence estimates with IPS weights and with raked weights were generally lower than estimates from other surveys although, as noted above, the surveys took place in different time periods.

Table 2-21. Demographic distributions based on adults responding to the Adult Extended Interview

	Adult respondents to Adult Extended Interview					
	Unweighted count	Weighted percentage using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage using adult raked weights	Confidence interval using adult raked weights	ACS PUMS Percentage
Sex						
Male	16,309	45.7%	[44. 9%, 46.6%]	48.1%	[48.1%, 48.1%]	48.1%
Female	15,982	54.3%	[53.4%, 55. 1%]	51.9%	[51.9%, 51.9%]	51.9%
Missing	29					
Total	**32,320**	**100.0%**		**100.0%**		**100.0%**
Age group						
18-24	9,110	13.8%	[13.2%, 14.4%]	13.0%	[13.0%, 13.0%]	13.0%
25-44	11,280	35.8%	[35.0%, 36.6%]	34.3%	[34.3%, 34.4%]	34.3%
45-64	8,818	33.7%	[32.8%, 34.5%]	34.5%	[34.5%, 34.5%]	34.5%
65+	3,110	16.7%	[16.0%, 17.4%]	18.2%	[18.2%, 18.2%]	18.2%
Missing	2					
Total	**32,320**	**100.0%**		**100.0%**		**100.0%**
Race						
Black alone or in combination	5,538	14.1%	[12.1%, 16.1%]	13.1%	[12.9%, 13.3%]	12.5%
White alone	23,242	77.4%	[75.1%, 79.7%]	77.9%	[77.6%, 78.1%]	75.7%
Other	2,726	8.5%	[7.5%, 9.5%]	9.0%	[8.8%, 9.3%]	11.8%
Missing	814					
Total	**32,320**	**100.0%**		**100.0%**		**100.0%**
Ethnicity						
Hispanic	5,536	17.8%	[15.3%, 20.3%]	15.2%	[15.1%, 15.3%]	15.0%
Non-Hispanic	26,288	82.2%	[79.7%, 84.7%]	84.8%	[84.7%, 84.9%]	85.0%
Missing	496					
Total	**32,320**	**100.0%**		**100.0%**		**100.0%**

Table 2-22. Comparison of education level and health insurance status based on adults responding to the Adult Extended Interview

	Adult respondents to Adult Extended Interview					
	Unweighted count	Weighted percentage using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage using adult raked weights	Confidence interval using adult raked weights	ACS PUMS Percentage
Education						
18-24						
< HS, HS or GED	4,465	49.9%	[48.1%, 51.7%]	43.5%	[43.4%, 43.6%]	43.6%
> HS	4,593	50.1%	[48.3%, 51.9%]	56.5%	[56.4%, 56.6%]	56.4%
Subtotal	**9,058**	**100.0%**		**100.0%**		**100.0%**
25+						
< HS or GED	4,769	18.0%	[16.9%, 19.1%]	16.9%	[16.8%, 17.0%]	16.9%
HS	4,763	20.0%	[19.1%, 21.0%]	23.8%	[23.8%, 23.9%]	23.8%
Some college, no degree	7,650	31.3%	[30.2%, 32.3%]	29.2%	[29.1%, 29.3%]	29.2%
Bachelor degree	3,642	18.2%	[17.1%, 19.2%]	18.7%	[18.7%, 18.8%]	18.7%
> Bachelor degree	2,228	12.5%	[11.5%, 13.5%]	11.4%	[11.3%, 11.4%]	11.3%
Subtotal	**23,052**	**100.0%**		**100.0%**		**100.0%**
Missing	210					
Total	**32,320**					
Health insurance						
Yes	25,760	84.4%	[83.5%, 85.2%]	85.5%	[84.9%, 86.0%]	83.3%
No	6,156	15.6%	[14.8%, 16.5%]	14.5%	[14.0%, 15.1%]	16.7%
Missing	404					
Total	**32,320**	**100.0%**		**100.0%**		**100.0%**

Table 2-23. Current cigarette smoking based on adults responding to the Adult Extended Interview

	Sample size	PATH Study: Unweighted percentage	PATH Study: Weighted percentage, using adult IPS weights [95% confidence interval]	PATH Study: Weighted percentage, using adult raked weights [95% confidence interval]	Percentage from 2010-2011 TUS-CPS [95% confidence interval]	Percentage from 2013 NHIS [95% confidence interval]	Percentage from 2011-2012 NHANES* [95% confidence interval]	Percentage from 2013 NSDUH, original definition** [95% confidence interval]	Percentage from 2013 NSDUH, modified definition [95% confidence interval]
Current smoker	32,245	35.4%	18.6% [17.7%, 19.4%]	18.1% [17.6%, 18.6%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]
Current smoker, male	16,265	36.8%	21.2% [20.3%, 22.2%]	20.9% [20.2%, 21.5%]	18.0% [17.7%, 18.4%	20.5% [19.5%, 21.4%]	23.9% [20.7%, 27.1%]	25.6% [25.1%, 26.1%]	23.8% [22.7%, 24.9%]
Current smoker, female	15,952	33.9%	16.4% [15.4%, 17.3%]	15.6% [15.0%, 16.3%]	14.2% [13.9%, 14.5%]	15.3% [14.6%, 16.0%]	16.0% [13.5%, 18.5%]	20.4% [20.0%, 20.8%]	18.4% [17.6%, 19.3%]
Current smoker, age 18-24	9,099	27.2%	20.1% [18.8%, 21.5%]	19.6% [18.4%, 20.8%]	17.1% [16.4%, 17.8%]	18.7% [16.8%, 20.5%]	20.4%*** [13.7%, 27.1%]	NA****	NA
Current smoker, age 25-44	11,260	41.2%	22.9% [21.8%, 24.1%]	22.9% [22.1%, 23.8%]	17.9% [17.5%, 18.4%]	20.1% [19.1%, 21.1%]	23.3% [20.0%, 26.7%]	NA	NA
Current smoker, age 45-64	8,784	40.6%	18.7% [17.7%, 19.8%]	18.3% [17.6%, 19.1%]	17.8% [17.4%, 18.2%]	20.0% [19.0%, 20.8%]	21.3% [18.3%, 24.2%]	NA	NA
Current smoker, age 65+	3,100	23.3%	7.7% [7.0%, 8.4%]	7.5% [6.9%, 8.2%]	7.8% [7.5%, 8.2%]	8.8% [8.0%, 9.6%]	9.2% [6.7%, 11.7%]	NA	NA
Current smoker, Hispanic	5,519	26.3%	13.4% [12.6%, 14.2%]	13.4% [12.6%, 14.2%]	10.9% [10.4%, 11.5%]	12.1% [11.0%, 13.2%]	16.6% [13.7%, 19.5%]	18.9% [18.1%, 19.7%]	15.2% [13.8%, 16.7%]
Current smoker, white non-Hispanic	19,268	38.8%	19.6% [18.5%, 20.7%]	19.2% [18.5%, 19.9%]	17.5% [17.2%, 17.8%]	19.4% [18.5%, 20.2%]	20.2% [17.0%, 23.3%]	24.1% [23.7%, 24.5%]	22.8% [21.9%, 23.6%]
Current smoker, other non-Hispanic	6,904	33.3%	20.4% [19.3%, 21.5%]	18.4% [17.5%, 19.3%]	NA	16.7% [15.6%, 17.8%]	20.8% [16.6%, 24.9%]	21.8% [20.2%, 23.4%]	19.6% [18.1%, 21.2%]
Current every-day smoker	32,245	28.0%	14.8% [13.9%, 15.6%]	14.4% [13.9%, 14.9%]	12.7% [12.4%, 12.9%]	13.7% [13.1%, 14.2%]	16.4% [14.3%, 18.4%]	NA	NA
Current some-days smoker	32,245	7.4%	3.8% [3.6%, 4.1%]	3.7% [3.5%, 3.9%]	3.4% [3.3%, 3.5%]	4.1% [3.8%, 4.4%]	3.4% [2.7%, 4.1%]	NA	NA

*The smoking questions asked in NHANES for adults ages 20 and older differ from the questions asked for persons ages 12-19. The modes of administration also differ for the two age groups. The NHANES estimates presented in this table are for adults ages 20 and older.

**NSDUH's definition of a current cigarette smoker is someone who has smoked part or all of a cigarette in the past 30 days, which is more expansive than the definition used in the other surveys. However, NSDUH contains questions on lifetime smoking and current smoking. The modified definition uses these questions to construct a measure of "current smoking" that is comparable to that of the other surveys (Ryan et al., 2012). The construction of this variable is described in Appendix A. The estimates and confidence intervals for the NSDUH "original definition" (except for the "current smoker, other non-Hispanic" estimate) are from the published tables (SAMHSA, 2014); the estimates and confidence intervals for the "modified definition" are calculated from the public use data set. The estimate of current smoking for the "other non-Hispanic" group was not available from the published tables and it was also calculated from the public use data set.

***The estimate is for adults 20-24 years old.

****Detailed age information was not available in the public use file for NSDUH 2013.

Table 2-24. Demographic distributions based on youth ages 12-17 who completed the Youth Interview

	Youth ages 12-17 respondents to Youth Interview					
	Unweighted count	Weighted percentage, using youth IPS weights	Confidence interval using youth IPS weights	Weighted percentage, using youth raked weights	Confidence interval using youth raked weights	ACS PUMS Percentage
Sex						
Male	6,971	51.2%	[50.3%, 52.1%]	51.3%	[51.3%, 51.4%]	51.3%
Female	6,641	48.8%	[47.9%, 49.7%]	48.7%	[48.6%, 48.7%]	48.7%
Missing	39					
Total	**13,651**	**100.0%**		**100.0%**		**100.0%**
Age group						
12-13	4,684	34.3%	[33.4%, 35.2%]	33.7%	[33.7%, 33.7%]	33.7%
14-17	8,965	65.7%	[64.8%, 66.6%]	66.3%	[66.3%, 66.3%]	66.3%
Missing	2					
Total	**13,651**	**100.0%**		**100.0%**		**100.0%**
Race/ethnicity						
Hispanic	3,880	28.6%	[25.2%, 32.1%]	22.1%	[22.0%, 22.2%]	22.3%
Non-Hispanic white alone	6,616	48.4%	[45.1%, 51.7%]	54.6%	[54.5%, 54.7%]	54.5%
Non-Hispanic other	3,135	23.0%	[20.5%, 25.5%]	23.3%	[23.3%, 23.4%]	23.2%
Missing	20					
Total	**13,651**	**100.0%**		**100.0%**		**100.0%**

Table 2-25. Cigarette smoking* based on youth ages 12-17 who completed the Youth Interview

	Sample size	PATH Study: Unweighted percentage	PATH Study: Weighted percentage, using youth IPS weights [95% confidence interval]	PATH Study: Weighted percentage, using youth raked weights [95% confidence interval]	Percentage from 2011-2012 NHANES [95% confidence interval]	Percentage from 2013 NSDUH [95% confidence interval]	Percentage from 2012 NYTS [95% confidence interval]
Ever tried cigarette smoking, even one or two puffs	13,631	13.5%	13.5% [12.6%, 14.5%]	13.4% [12.6%, 14.2%]	20.5% [17.5%, 23.6%]	15.7% [15.4%, 16.0%]	25.6% [23.6%, 27.6%]
Ever tried smoking, male	6,959	13.9%	14.0% [13.0%, 15.1%]	14.0% [13.0%, 15.0%]	21.1% [15.9%, 26.3%]	16.3% [15.8%, 16.8%]	27.2% [25.0%, 29.3%]
Ever tried smoking, female	6,634	13.1%	13.1% [12.0%, 14.2%]	12.8% [11.8%, 13.8%]	20.0% [14.6%, 25.5%]	15.1% [14.6%, 15.6%]	24.0% [21.8%, 26.2%]
Ever tried smoking, age 12-13	4,675	4.6%	4.6% [3.9%, 5.4%]	4.5% [3.8%, 5.2%]	5.6% [1.9%, 9.4%]	4.0% [3.7%, 4.3%]	11.8% [10.2%, 13.4%]
Ever tried smoking, age 14-17	8,954	18.1%	18.2% [17.1%, 19.4%]	18.0% [16.9%, 19.0%]	28.3% [23.5%, 33.0%]	21.0% [20.0%, 22.0%]	32.5% [30.0%, 34.9%]
Have smoked in past 30 days	13,613	4.7%	4.7% [4.2%, 5.1%]	4.6% [4.2%, 5.0%]	6.9% [4.0%, 9.8%]	5.6% [5.4%, 5.8%]	8.7% [7.7%, 9.8%]

*Defined as ever tried a cigarette, even one or two puffs. For comparison, an additional measure of current smoking commonly applied to youth (having smoked at all in the past 30 days) is also included in this table.

2.3.2 Biospecimens

The adult raked weight ARKWT is also used for the analysis of adults in the full Wave 1 sample who provide biospecimens. Tables 2-26 and 2-27 present estimates of demographic characteristics, education, and health insurance for adults who provided biospecimens, using the adult raked weight ARKWT. Although the raking was performed on the adults responding to the Adult Extended Interview, and no additional adjustments were performed on the adults from whom biospecimens were collected, this raking brings the estimated sex, age, race, and ethnicity distributions for adults who provided urine specimens closer to estimates from the 1-year 2013 ACS. The raking also resulted in estimated percentages of females, Blacks, and Hispanics from the adults who provided blood samples that are closer to the 1-year 2013 ACS estimates, although the estimated age distribution for the adults who provided blood samples differs from the ACS distribution. Table 2-27 shows that the raking decreased the estimated percentages of adults at the lowest level of education, bringing those closer to the ACS estimates. Raking increased the estimated percentages of adults with health insurance for each type of biospecimen.

Table 2-28 gives estimates of current cigarette smoking prevalence for the adults from whom urine or blood specimens were collected. The estimates of cigarette smoking prevalence calculated with the raked weights are little changed from the estimates calculated with the IPS weights. The estimates of cigarette smoking prevalence are higher for both sets of biospecimen providers than for the full set of respondents to the Adult Extended Interview; however, all estimates are within the range of estimates from the comparison surveys.

The results in Tables 2-26 to 2-28 show estimates from the adults who provided urine or blood specimens, but not all specimens collected will be analyzed in the laboratory. Approximately 6,000 blood samples and 10,000 urine samples will be chosen initially for laboratory analysis. These biospecimens come from a probability sample of adults who are in specified tobacco use categories.[17]

[17] These categories are: current exclusive established users of cigarettes, current established users of other tobacco products, current experimental users only of any tobacco product, former established users of any product whose last use was within the past 12 months, and never users. In other categories of tobacco use, no samples are selected for laboratory analysis. Consequently, the samples of biospecimens will be representative of the persons in the specified tobacco use categories, but not of the adult population as a whole.

Table 2-26. Demographic distributions based on adults from whom urine or blood specimens were collected

	Adults from whom urine specimen is collected					Adults from whom blood specimen is collected					
	Un-weighted count	Weighted percentage using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage using adult raked weights	Confidence interval using adult raked weights	Un-weighted count	Weighted percentage using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage using adult raked weights	Confidence interval using adult raked weights	ACS PUMS Percentage
Sex											
Male	10,763	44.9%	[43.9%, 45.9%]	47.1%	[46.5%, 47.8%]	6,920	43.7%	[42.6%, 44.8%]	46.0%	[45.2%, 46.9%]	48.1%
Female	11,025	55.1%	[54.1%, 56.1%]	52.9%	[52.2%, 53.5%]	7,594	56.3%	[55.2%, 57.4%]	54.0%	[53.1%, 54.8%]	51.9%
Missing	13					6					
Total	**21,801**	**100.0%**		**100.0%**		**14,518**	**100.0%**		**100.0%**		**100.0%**
Age group											
18-24	6,457	14.9%	[14.2%, 15.6%]	14.1%	[13.8%, 14.4%]	3,884	13.3%	[12.5%, 14.0%]	12.4%	[12.0%, 12.8%]	13.0%
25-44	7,744	37.0%	[36.0%, 38.0%]	35.5%	[34.9%, 36.1%]	5,005	34.1%	[33.1%, 35.2%]	32.7%	[31.9%, 33.5%]	34.3%
45-64	5,725	33.0%	[32.0%, 33.9%]	33.7%	[33.1%, 34.3%]	4,191	35.6%	[34.4%, 36.7%]	36.2%	[35.2%, 37.1%]	34.5%
65+	1,873	15.1%	[14.3%, 15.9%]	16.7%	[16.0%, 17.3%]	1,438	17.1%	[16.1%, 18.1%]	18.7%	[17.9%, 19.6%]	18.2%
Missing	2					0					
Total	**21,801**	**100.0%**		**100.0%**		**14,518**	**100.0%**		**100.0%**		**100.0%**
Race											
Black alone or in combination	3,911	14.8%	[12.6%, 17.0%]	13.8%	[13.3%, 14.3%]	2,381	13.2%	[11.2%, 15.2%]	12.2%	[11.6%, 12.8%]	12.5%
White alone	15,531	77.0%	[74.6%, 79.4%]	77.8%	[77.1%, 78.5%]	10,637	79.3%	[77.1%, 81.5%]	80.5%	[79.7%, 81.4%]	75.7%
Other	1,801	8.2%	[7.2%, 9.2%]	8.4%	[7.9%, 9.0%]	1,152	7.5%	[6.7%, 8.4%]	7.3%	[6.7%, 7.9%]	11.8%
Missing	558					348					
Total	**21,801**	**100.0%**		**100.0%**		**14,518**	**100.0%**		**100.0%**		**100.0%**
Ethnicity											
Hispanic	3,870	18.6%	[16.0%, 21.2%]	16.0%	[15.5%, 16.5%]	2,451	16.7%	[13.9%, 19.5%]	14.3%	[13.6%, 15.0%]	15.0%
Non-Hispanic	17,633	81.4%	[78.8%, 84.0%]	84.0%	[83.5%, 84.5%]	11,884	83.3%	[80.5%, 86.1%]	85.7%	[85.0%, 86.4%]	85.0%
Missing	298					183					
Total	**21,801**	**100.0%**		**100.0%**		**14,518**	**100.0%**		**100.0%**		**100.0%**

Table 2-27. Comparison of education level and health insurance status based on adults from whom urine or blood specimens were collected

	Adults from whom urine specimen collected					Adults from whom blood specimen collected					ACS PUMS Percentage
	Unweighted count	Weighted percentage using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage using adult raked weights	Confidence interval using adult raked weights	Unweighted count	Weighted percentage using adult IPS weights	Confidence interval using adult IPS weights	Weighted percentage using adult raked weights	Confidence interval using adult raked weights	
Education											
18-24											
<HS, HS or GED	3,234	50.4%	[48.3%, 52.5%]	44.3%	[43.4%, 45.2%]	1,948	50.2%	[47.7%, 52.6%]	43.8%	[42.1%, 45.5%]	43.6%
>HS	3,197	49.6%	[47.5%, 51.7%]	55.7%	[54.8%, 56.6%]	1,928	49.8%	[47.4%, 52.3%]	56.2%	[54.5%, 57.9%]	56.4%
Subtotal	6,431	100.0%		100.0%		3,876	100.0%		100.0%		100.0%
25+											
< HS or GED	3,425	19.3%	[18.1%, 20.6%]	18.4%	[17.9%, 18.9%]	2,405	19.0%	[17.6%, 20.5%]	18.2%	[17.4%, 19.1%]	16.9%
HS	3,106	19.8%	[18.6%, 20.9%]	23.5%	[22.7%, 24.2%]	2,071	19.0%	[17.7%, 20.2%]	22.6%	[21.6%, 23.7%]	23.8%
Some college, no degree	5,238	32.4%	[31.3%, 33.4%]	30.3%	[29.7%, 30.9%]	3,721	33.4%	[31.9%, 34.9%]	31.2%	[30.3%, 32.1%]	29.2%
Bachelor degree	2,139	16.7%	[15.6%, 17.9%]	17.3%	[16.8%, 17.9%]	1,454	16.7%	[15.3%, 18.1%]	17.2%	[16.3%, 18.2%]	18.7%
> Bachelor degree	1,369	11.8%	[10.8%, 12.8%]	10.5%	[10.1%, 10.9%]	956	11.9%	[10.8%, 13.1%]	10.7%	[10.1%, 11.3%]	11.3%
Subtotal	15,277	100.0%		100.0%		10,607	100.0%		100.0%		
Missing	93					37					
Total	**21,801**					**14,520**					
Health insurance											
Yes	17,306	83.9%	[83.0%, 84.8%]	84.9%	[84.2%, 85.6%]	11,686	85.0%	[84.0%, 86.0%]	86.0%	[85.1%, 86.8%]	83.3%
No	4,335	16.1%	[15.2%, 17.0%]	15.1%	[14.4%, 15.8%]	2,758	15.0%	[14.0%, 16.0%]	14.0%	[13.2%, 14.9%]	16.7%
Missing	160					76					
Total	**21,801**	**100.0%**		**100.0%**		**14,520**	**100.0%**		**100%**		**100.0%**

Table 2-28. Current cigarette smoking based on adults from whom biospecimens were collected

	Sample size	PATH Study: Weighted cigarette smoking prevalence, using adult IPS weights [95% confidence interval]	PATH Study: Weighted cigarette smoking prevalence, using adult raked weights [95% confidence interval]	Percentage from 2010-2011 TUS-CPS [95% confidence interval]	Percentage from 2013 NHIS [95% confidence interval]	Percentage from 2011-2012 NHANES [95% confidence interval]	Percentage from 2013 NSDUH, original definition* [95% confidence interval]	Percentage from 2013 NSDUH, modified definition [95% confidence interval]
Adult respondent to Adult Extended Interview	32,245	18.6% [17.7%, 19.4%]	18.2% [17.7%, 18.7%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]
Adults providing urine	21,757	20.9% [20.0%, 21.9%]	20.4% [19.7%, 21.1%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]
Adults providing blood	14,493	21.6% [20.5%, 22.7%]	20.9% [20.1%, 21.8%]	16.1% [15.8%, 16.3%]	17.8% [17.2%, 18.4%]	19.8% [17.5%, 22.1%]	22.9% [22.6%, 23.2%]	21.0% [20.4%, 21.7%]

*NSDUH's definition of a current cigarette smoker is someone who has smoked part or all of a cigarette in the past 30 days. However, NSDUH contains questions on lifetime smoking and current smoking. The modified definition uses these questions to construct a measure of "current smoking" that is comparable to that of the other surveys (Ryan et al., 2012). The construction of this variable is described in Appendix A.

These weights would multiply ARKWT by an adjustment calculated using weighting adjustment cells based on Wave 1 characteristics such as demographics, education, employment status, health insurance, and tobacco use. These weights would not produce estimates for the full target population of the PATH Study, however, but only for the union of the tobacco use categories from which biospecimens were selected for analysis.

2.4 Summary of Findings

Response Rates

As reported in Section 2.1, the weighted response rates[18] for the PATH Study Household Screener and Adult Interview and the biospecimen collections in Wave 1 are lower than projected (see Table 2-29), and the weighted response rates for all collections are higher than the worst-case scenario rates for the full sample provided in Attachment 22. The weighted response rate for the PATH Study Youth Interview is higher than projected.

Table 2-29. Summary of PATH Study Wave 1 overall response rates

Collection	Unweighted response rate, based on full Wave 1 sample	Weighted response rate, based on full Wave 1 sample	Projected response rate*	Worst-case scenario response rate*
Household Screener	54.1%	54.0%	70%	39.7%
Adult Extended Interview	74.8%	74.0%	85%	58.1%
Youth Interview	78.2%	78.4%	75%	–
Urine	67.5%	63.6%	80%	49%
Blood	44.9%	43.0%	65%	39%

*Provided in the request to OMB for Wave 1 data and biospecimen collection.

The differential weighted response rates are modest for tobacco use status and demographic subgroups (see Tables 2-1, 2-2, 2-3, and 2-4.) The largest differential weighted response rate, 11.5 percentage points, is for the age of adults who provide urine samples, which suggests a heightened potential for nonresponse bias. Notably, the differential weighted response rates for blood collection, ranging from 3.2 percentage points for ethnicity to 5.8 percentage points for race, were more consistent with those of other PATH Study collections.

[18] These response rates were weighted with inverse probability of selection weights.

Nonresponse Bias Analysis

Nonresponse bias analysis indicates that estimates of key demographic and tobacco use variables calculated from the PATH Study Wave 1 sample with the inverse probability of selection weights are comparable to those produced by national cross-sectional surveys. However, the completed household interviews from the Wave 1 sample appear to underrepresent single- and two-person households relative to the 1-year 2013 ACS counts. The estimated percentage of persons who are non-Black and 25 years of age or older, from the household rosters, is also smaller than the corresponding estimate from the ACS.

Estimated distributions of demographic characteristics for adults completing the Adult Extended Interview are similar to those from the 1-year 2013 ACS for race (except for persons in the "other race" category). Persons in the "other race" category are also underrepresented among the persons providing blood or urine specimens. The estimated percentages of adults who are Hispanic are similar to ACS values for adults who provided blood specimens, but Hispanics are overrepresented among adults who responded to the Adult Extended Interview and those who provided urine specimens. In addition, the estimated percentage of adults who are between 18 and 24 years old or between 25 and 44 years old is higher for the PATH Study than for the ACS for adult respondents as a whole and for those who provided urine specimens. Males are underrepresented among respondents to the Adult Extended Interview, and also among the persons who provided blood or urine specimens.

When compared to national cross-sectional surveys that measure tobacco use (TUS-CPS, NHIS, NHANES, and NSDUH), estimates of adult cigarette smoking from the PATH Study Wave 1 sample are roughly in the middle of the range of estimates on smoking. There is no indication of nonresponse bias with respect to this measure.

Estimates of demographic characteristics of youth in Wave 1 align with the 1-year 2013 ACS for most demographic characteristics. However, the estimated percentage of youth who are Hispanic youth from the PATH Study is significantly higher than the corresponding percentage estimated from the ACS. (The nonresponse weight adjustments correct for this difference.)

PATH Study estimates of the selected youth cigarette smoking measure from the full Wave 1 sample are at the low end of estimates in comparison with national cross-sectional surveys that measure tobacco use (NHANES, NSDUH, and NYTS). However, estimates from the comparison surveys

are from 2011 through 2013 while those from the PATH Study are from September 2013 through December 2014, and evidence suggests the use of traditional cigarettes is declining among youth. The difference among surveys on time period alone is not large enough to account for the different estimates; as indicated in Section 2.2.2, time period is one of a number of factors that may explain the different estimates.

Statistical Approach for Addressing Nonresponse

The approach used to reduce potential nonresponse bias in the PATH Study is to adjust the weights of respondents at the household, adult, and youth levels to account for nonrespondents. Results of applying this approach to the full Wave 1 sample indicate the nonresponse adjustments are successful for reducing the discrepancy between the PATH Study estimates and 1-year estimates from the 2013 ACS with respect to demographic characteristics. Raked weights used for adults responding to the Adult Extended Interview reduced differences between the PATH Study and ACS for adults providing biospecimens as well, for sex and ethnicity. The raking did not reduce differences in the age distributions for the persons providing blood specimens.

Estimates of adult cigarette smoking using the IPS weights (before nonresponse adjustment) are in line with estimates from other surveys; agreement in these estimates is preserved using the nonresponse-adjusted weights. Weighting adjustments for youth corrected for the slight overestimate of the percentage of Hispanics among youth in Wave 1 but had little effect on the other demographic characteristics (i.e., IPS-weighted estimates already agreed with the ACS values) and estimates of youth cigarette smoking.

Conclusions 3

This section summarizes the findings presented in this report on the PATH Study's Wave 1 response rates, nonresponse bias analysis, and approach to addressing nonresponse. based on the full sample for Wave 1.

Response rates in Wave 1 for the Household Screener and Adult Extended Interview were lower than projected in the Non-substantive Change Request for Wave 1 of the PATH Study but higher than the worst-case scenario. However, nonresponse bias analysis found that many characteristics of respondents in Wave 1 align with the 1-year estimates from the 2013 ACS. Exceptions were found for single-person households, education, and ethnicity when comparing PATH Study estimates using IPS weights to 1-year 2013 ACS estimates. Estimates of cigarette smoking among adults in Wave 1 are within the range of estimates found by other national health studies. Moreover, when full sample estimates were adjusted for nonresponse using the raked weights, they more closely approximated the ACS estimates, and adult smoking rates remained essentially the same.

The response rate for the Wave 1 Youth Interview was higher than projected. Nonresponse bias analysis among youth found that many characteristics of respondents were consistent with the 1-year estimates from the 2013 ACS, with the exception of ethnicity. When the full sample estimates were adjusted for nonresponse among youth, they more closely approximated the 2013 ACS estimates, but the ever-tried-smoking rates for youth remained lower than those found by other national studies.

The response rates for urine and blood collections in Wave 1 were lower than projected and exceeded the worst-case scenario response rates. Despite this, nonresponse bias analysis found that many of the characteristics of respondents were generally aligned with estimates of these characteristics from the 1-year 2013 ACS. In addition, when the sample estimates were adjusted for nonresponse, they were found to approximate the ACS estimates more closely.

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Appendix A
Cigarette Smoking Questions on the PATH Study and Other Surveys

Table A-1 lists the questions used to ask about current smoking status of adults in the PATH Study and in the surveys used for comparison and describes the populations included in the estimates from those surveys.

Note that although the questions used to define current cigarette smoking are similar among the surveys, small differences could have an effect on the answers given. In the PATH Study, the question used to establish whether an adult has smoked at least 100 cigarettes in his or her lifetime has closed response categories:

1. 1 or more puffs but never a whole cigarette;
2. 1 to 10 cigarettes (about ½ pack total);
3. 11 to 20 cigarettes (about ½ pack to 1 pack);
4. 21 to 50 cigarettes (more than 1 pack but less than 3 packs);
5. 51 to 99 (more than 2 ½ packs but less than 5 packs); and
6. 100 or more cigarettes (5 packs or more).

In TUS-CPS, NHIS, and NHANES, however, the question "Have you smoked at least 100 cigarettes in your entire life?" calls for a yes/no response.

The positioning of the questions also differs among the surveys. In the PATH Study, the cigarette smoking questions are near the beginning of the adult questionnaire, and the respondent knows that the questionnaire is about tobacco use behaviors. In TUS-CPS, the smoking questions are near the beginning of the adult questionnaire on tobacco, but the survey is administered as part of the CPS. In NHIS, the smoking questions follow a long series of questions on health problems (breathing problems, diabetes, hernias, hemorrhoids, etc.). These question contexts may be associated with differences in responses.

Table A-2 lists the questions used to define youth cigarette smoking in the PATH Study, NHANES, NSDUH, and NYTS.

Table A-1. Question used to define "current smoking" in the PATH Study, TUS-CPS, NHIS, NHANES, and NSDUH

PATH Study	TUS-CPS**	NHIS	NHANES	NSDUH (original definition)	NSDUH (modified definition)*
Question to define current smoking (answers defining current smoking given in parentheses)					
"Have you ever smoked a cigarette, even one or two puffs?" (yes) and "Do you now smoke cigarettes every day, some days, or not at all?" (every day or some days) and "How many cigarettes have you smoked in your entire life? A pack usually has 20 cigarettes in it." (100 or more cigarettes (5 packs or more))	"Have you smoked at least 100 cigarettes in your entire life?" (yes) and "Do you now smoke cigarettes every day, some days, or not at all?" (every day or some days) (PEA1, PEA3)	"Have you smoked at least 100 cigarettes in your ENTIRE LIFE?" (yes) and "Do you NOW smoke cigarettes every day, some days or not at all?" (every day or some days) (SMQEV, SMKNOW)	"{Have you/Has SP} smoked at least 100 cigarettes in {your/his/her} entire life?" (yes) and "{Do you/Does SP} now smoke cigarettes every day, some days or not at all?" (every day or some days) (SMQ020, SMQ040)	"Have you ever smoked part or all of a cigarette?" (yes) and "During the past 30 days, have you smoked part or all of a cigarette?" (yes)	"Have you ever smoked part or all of a cigarette?" (yes) and "During the past 30 days, have you smoked part or all of a cigarette?" (yes) and "Have you smoked at least 100 cigarettes in your entire life?" (yes)
Age range included in estimate					
18+	18+	18+	20+	18+	18+
Exclusions from population					
Includes only civilian, non-institutionalized population. Excludes residents of group quarters, active military.	Includes only civilian, non-institutionalized population.	Includes only civilian noninstitutionalized population. Several segments of the population excluded, such as: patients in long-term care facilities; persons on active duty with the Armed Forces; persons incarcerated in the prison system; and U.S. nationals living in foreign countries.	Includes only civilian, non-institutionalized population.	Includes only civilian, non-institutionalized population. Excludes homeless persons who do not use shelters, military personnel on active duty, and residents of institutional group quarters.	
Proxy responses allowed					
No	Yes	Yes, for individuals physically or mentally incapable of responding.	No	No	No

*The modified definition is given in Ryan et al. (2012).

** Proxies are allowed if 4th callback, the person will not return before closeout, or the household is getting irritated. See http://appliedresearch.cancer.gov/studies/tus-cps/surveys/tuscps_english_2010.pdf, p3.

Table A-2. Questions used for youth cigarette smoking in the PATH Study, NHANES, NSDUH, and NYTS

PATH Study	NHANES	NSDUH	NYTS
Question to define ever tried cigarette smoking (answers defining ever tried cigarette smoking given in parentheses)			
"Have you ever tried cigarette smoking, even one or two puffs?" (yes)	"About how many cigarettes have you smoked in your entire life?" (SMQ621, values of 2-8 (more than a puff to 100 or more cigarettes)) I have never smoked, not even a puff (1), 1 or more puffs but never a whole cigarette (2), 1 cigarette (3), 16 to 25 cigarettes (6), 2 to 5 cigarettes (4), 26 to 99 cigarettes (7), 6 to 15 cigarettes (5), 100 or more cigarettes (8)	CG01 Have you ever smoked part or all of a cigarette? (yes)	Have you ever tried cigarette smoking, even one or two puffs? (Qn7 value of 1, Yes)
Questions for determining whether have smoked in past 30 days			
"Have you ever tried cigarette smoking, even one or two puffs?" (yes) and "When was the last time you smoked a cigarette, even one or two puffs?" (Earlier today, Not today but sometime in the past 7 days, Not in the past 7 days but sometime in the past 30 days)	"During the past 30 days, on how many days did you smoke cigarettes?" (SMQ640, Recoded to SMD641 in SMQ_G file, number of day smoked, values of 1 through 30)	CG05 [IF CG01 = 1 OR CGREF1 = 1] Now think about the past 30 days – that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette?	During the past 30 days, on how many days did you smoke cigarettes? (Qn13 values of 2 through 7)
Ages of youth in survey			
12-17	12-17	12-17	12-17 year old students in public or private schools
Exclusions from population			
Residents of group quarters	Includes only the U.S. civilian, noninstitutionalized population.	Includes only the U.S. civilian, noninstitutionalized population. Excludes homeless persons who do not use shelters, military personnel on active duty, and residents of institutional group quarters.	Only includes youth who attend either public or private schools.
Other comments			
	Those missing SMQ621 values are excluded from the estimates. Those with SMQ621=1, 2, 77 or 99 (never smoked, less than 1 cigarette, RF, DK) had SMD640 recoded to 0 (0 cigarette smoked in past 30 days) due to skip pattern.	The Center for Behavioral Health Statistics and Quality (2013, 2014) give estimates and the standard errors of the estimates.	The survey is administered by teachers in the classroom setting.