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Data and Biospecimen Collection Nonresponse Bias Analysis for Wave 3

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Population Assessment of Tobacco and Health
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PATH Study Wave 3 Data and Biospecimen Collection
Nonresponse Bias Analysis Report

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1 Introduction

Westat prepared this report as a reference document for researchers using the Population Assessment of Tobacco and Health (PATH) Study interview and biomarker data. This report focuses on the Wave 3 response rates and potential nonresponse biases for select demographic and outcome measures conditioning on Wave 1 participation. Similar reports are also available for Wave 1 and Wave 2, and can be found at the website for the National Addiction & HIV Data Archive Program (NAHDAP).

All Wave 1 participants were eligible for Wave 3 data collection unless they were incarcerated, deceased, or resided outside of the U.S. at the time of Wave 3 data collection. The potential for Wave 3 nonresponse bias is evaluated conditioning on Wave 1 participation, so a brief summary of the findings from the Wave 1 nonresponse bias analyses is provided below:

- For the Wave 1 Household Screener and Adult Interview, most demographic and socio-economic characteristics of the respondents in Wave 1 aligned with estimates from the 2013 American Community Survey (ACS) when using the basic design weights, also known as the inverse-of-probability-of-selection (IPS) weights for the PATH Study. Exceptions were found for single-person households, education, and ethnicity when comparing Wave 1 estimates using the IPS weights to the 2013 ACS estimates. Estimates of cigarette-smoking rates among adults in Wave 1 were within the range of estimates found in other national health studies. When the estimates were adjusted for nonresponse using the Wave 1 final weights, they more closely approximated the ACS estimates and adult cigarette-smoking rates remained essentially the same.

- For the Wave 1 Youth Interview, most demographic characteristics of respondents were consistent with the estimates from the 2013 ACS, with the exception of ethnicity, when using the IPS weights. When the estimates were adjusted for nonresponse among youth, they more closely approximated the 2013 ACS estimates, , but the ever-tried cigarette-smoking rates for all youth in Wave 1 remained 2 to 12 percentage points lower than those found in other national studies.

- For the Wave 1 urine and blood collections, most of the demographic and socio-economic characteristics of specimen providers generally aligned with estimates of these characteristics from the 2013 ACS, when using the IPS weights. In addition, when the estimates were adjusted for nonresponse, they were found to approximate the ACS estimates more closely.

This report is organized as follows: Section 2 provides an overview of the PATH Study sample design. Section 3 describes the methodology used for the analyses in this report. Sections 4 and 5 present the results for interview response rates and potential nonresponse bias assessment conditioning on Wave 1 participation, for adults and youth, respectively. Section 6 addresses the response rates and potential nonresponse biases for adult biospecimen collections. Section 7 summarizes the findings and discusses their implications.

Overview of Sample Design and Data Collection 2

This section provides an overview of the sample design for the PATH Study. Information on the study background and overall design is also provided in Chapter 2 of the PATH Study Restricted Use Files (RUF) User Guide.

2.1 Wave 1

The target population of the PATH Study at Wave 1 was the civilian, noninstitutionalized U.S. population (i.e., including the 50 states and the District of Columbia) nine years of age and older at that point in time. Thus, active duty military personnel and those residing in an institutional setting were excluded. College students living away from home during the school year were identified as members of their permanent residence (e.g., parents' home). For Wave 1, a four-stage stratified area probability sample design was used with a two-phase design for sampling adults 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 (consisting of one or more census blocks) were formed and then a sample of these segments was drawn. At the third stage, a sample of addresses within sampled segments was drawn from listings of addresses; the main source of these addresses was obtained from the Postal Service (USPS) Computerized Delivery Sequence Files (CDSFs). The CDSFs provide very high coverage of the residential addresses in the U.S. The fourth stage was the random selection of persons within sampled households.

For within-household selection, a roster of all the members in the sampled household was constructed using the Household Screener. An adult household member, the household screener respondent, was asked to list members of the household and provide demographic as well as, for each adult, tobacco-use information. This information was used 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 interviewed as youth in later waves of the study upon reaching 12 years of age.

Two-phase sampling was used for adult selection due to potential misreporting by the household screener respondent of the tobacco-use status of other adult household members. The Phase 1 sampling depended on the age, race, and tobacco-use information obtained from the Household Screener. The Phase 2 sampling was based on 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 PATH Study Wave 1 interview data and biospecimen collections started on September 12, 2013 and ended on December 14, 2014. In Wave 1, 32,320 Adult Interviews and 13,651 Youth Interviews were completed. All Adult Interview respondents were asked to provide urine and blood specimens; 21,801 provided a urine specimen and 14,520 provided a blood specimen. The Wave 1 Data and Biospecimen Collection Nonresponse Bias Analysis Report can be found at the NAHDAP website.

2.2 Wave 2 and Wave 3

There was no additional sampling for Wave 2 or Wave 3 of the PATH Study. Wave 2 was the first follow-up wave for the Wave 1 participants. The target population for Wave 2 is the Wave 1 target population residing in the U.S. at Wave 2 with the exception of those who were incarcerated. Thus, Wave 1 respondents who later joined the military or entered a health care institution (e.g., nursing home) were members of the target population and eligible for Wave 2 data collection. At Wave 2, only Wave 1 respondents who died, resided outside the U.S., or were in a correctional facility were ineligible for a Wave 2 interview.

During the Wave 2 data collection period, attempts were made to contact the Wave 1 youth and adult respondents as well as members of the shadow youth sample established at Wave 1. Shadow youth who turned age 12 by Wave 2 and were permitted by a parent or guardian to participate in the study were asked for assent to be interviewed for the first time at Wave 2. Similarly, persons in the youth sample at Wave 1 who reached age 18 by Wave 2 were asked to complete the Adult Interview and to provide urine and blood specimens.

The PATH Study Wave 2 interview data and biospecimen collections started on October 23, 2014 and ended on October 30, 2015. In Wave 2, 28,362 Adult Interviews and 12,172 Youth Interviews were completed. The study subsampled 14,465 adults for urine collection at Wave 2 from adults who provided urine specimens at Wave 1; among these subsampled adults, 12,561 completed the Wave 2 interview and 12,109 provided urine specimens again at Wave 2. The study also collected 1,587 urine specimens and 908 blood specimens from the 1,915 persons who had completed the PATH Study Adult Interview for the first time (referred to as "first-time Adult Interview respondents") at Wave 2. The Wave 2 Data and Biospecimen Collection Nonresponse Bias Analysis Report can be found at the NAHDAP website.

Wave 3 was the second follow-up wave of the PATH Study. The target population for the PATH Study in Wave 3 is the resident population of the U.S. at the time of Wave 3 (other than those who were incarcerated) who were in the civilian, noninstitutionalized population nine years of age or older at Wave 1. Note that in addition to the Wave 2 participants, Wave 2 non-participants who had participated in Wave 1 were also fielded for Wave 3 data collection unless their non-participation at Wave 2 was due to a firm or hostile refusal, death, language barrier,[1] or a physical or mental disability that prevented participation in the study. Shadow youth from previous waves who turned age 12 by Wave 3 and were permitted by a parent or guardian to participate in the study were asked for assent to be interviewed for the first time at Wave 3. Similarly, youth from previous waves who reached age 18 by Wave 3 were asked to complete the Adult Interview and to provide urine and blood specimens.

The PATH Study Wave 3 interview data and biospecimen collections started on October 19, 2015 and ended on October 23, 2016. In Wave 3, 28,148 Adult Interviews and 11,814 Youth Interviews were completed. The study subsampled 13,700 adults for urine collection at Wave 3 from adults who had provided urine specimens in Wave 1 and/or Wave 2; among these subsampled adults, 13,338 provided urine specimens again at Wave 3. The study also collected 1,641 urine specimens and 835 blood specimens from the 1,907 first-time Adult Interview respondents in Wave 3.

[1] The PATH Study interviews can be conducted in English or Spanish. At Wave 2, the cases assigned a final nonresponse status due to language problems included two groups: (a) Wave 1 respondents who mentioned difficulty completing the Wave 1 interview in English or Spanish as their main reason for not cooperating at Wave 2; and (b) Wave 1 shadow youth who did not feel comfortable completing an interview in English or Spanish when asked to do so by the study for the first time.

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Methodology 3

This section first discusses the factors affecting nonresponse bias, and then describes the methods used for evaluating potential nonresponse bias in this report.

3.1 Factors Affecting Nonresponse Bias

Bias is the difference between a survey estimate and the actual population value. Although nonresponse bias can be a major concern in multi-stage household surveys, nonresponse does not necessarily induce nonresponse bias in survey estimates. Assuming nonresponse to be a fixed property of an individual, the nonresponse bias of an estimate can be expressed mathematically to show the relationship between the bias and two factors—the amount of nonresponse and the difference between respondents and nonrespondents—(Groves, 2006):

$$Bias(\bar{y}_r) = (1 - r)(\bar{Y}_r - \bar{Y}_m)$$

where $\bar{y}_r$ is the estimated mean based on the respondents only, r is the response rate, $\bar{Y}_r$ is the mean of the respondents in the target population, and $\bar{Y}_m$ is the mean of the nonrespondents in the target population.

That is, the magnitude of nonresponse bias depends on the correlation between response propensity and the measure of interest. Within the same survey, different estimates can be subject to different levels of nonresponse bias. Some measures, unrelated to the propensity to respond, can be immune from the biasing effect of nonresponse; others, in the same survey, can be subject to large biases (Groves, 2006).

In practice, survey practitioners often attempt to decrease potential nonresponse bias by not only increasing the overall response rate but also improving cooperation from the "difficult to reach" subgroups. In addition, effective statistical adjustments can also help reduce potential nonresponse biases in some survey estimates.

3.2 Analyses for Evaluating Wave 3 Potential Nonresponse Bias

It is not always possible to measure the actual bias due to nonresponse; however, there are different approaches that help identify potential sources of nonresponse bias. Several analyses were conducted to assess the potential nonresponse bias (conditioning on Wave 1 participation) in estimates from Wave 3 of the PATH Study.

3.2.1 Comparison of Interview Response Rates across Subgroups

Although a response rate does not yield direct estimates of potential nonresponse biases on key measures, examining response rates by subgroups may reveal sources of potential nonresponse bias.

All Wave 1 study participants were eligible for Wave 3 unless they were incarcerated, deceased, or resided outside of the U.S. at the time of Wave 3 data collection. All Wave 3 interview response rates presented in this report are conditioning on Wave 1 participation. However, to avoid repetition, the fact that these are conditional response rates is not reiterated every time the Adult Interview and Youth Interview response rates are discussed in Sections 4.1 and 5.1. As in previous waves, persons 18 and older were asked to complete an Adult Interview and persons 12 to 17 were asked to complete a Youth Interview. Response rates were calculated for the Wave 3 Adult Interview and Youth Interview separately.

A Wave 3 nonrespondent did not have a Wave 3 interview date, so his/her Wave 3 age and interview type (i.e., Adult Interview versus Youth Interview) were determined using the best available date of birth or age information. The latest such information was assumed the best for classifying age and interview type. Each person had an "anniversary month" for Wave 3 based on the Wave 2 (or Wave 1) interview date(s) of the study member(s) in his/her household. The age classification date for a Wave 3 nonrespondent was 1 month after the last day of his/her anniversary month or the final date of the Wave 3 data collection, whichever was earlier. A nonrespondent was considered eligible for a Wave 3 Youth Interview if his/her age was determined to be between 12 and 17 on the age classification date, or eligible for a Wave 3 Adult Interview if his/her age was determined to be 18 or older on the age classification date.

Both weighted and unweighted Wave 3 interview response rates were computed for each interview type (adult or youth), and compared across population subgroups (for example, male versus female).

The unweighted response rate measures the success of field operations in obtaining responses from the sampled persons. The weighted response rate estimates the proportion of the population represented by the sampled persons that would have responded if they all had been asked to participate in the study, and thus provides a measure of the potential impact of nonresponse on the study estimates. The Wave 1 basic design weights, also known as the IPS weights for the PATH Study, were used for calculating the weighted response rates.

3.2.2 Comparison to "Frame" Data from Wave 1

In a longitudinal study, the information collected in the baseline wave can be viewed as "frame" information for future waves, and thus used for evaluating potential nonresponse bias (Bose and West, 2002; Javitz and Wagner, 2005; Brownstein et al., 2009). For the PATH Study, estimates based on Wave 3 interview respondents were compared to the "frame" information from the baseline wave (Wave 1) for Wave 3 adults and youth, separately. This comparison helps identify characteristics that might be associated with nonresponse bias due to attrition between Wave 1 and Wave 3, after compensating for Wave 1 nonresponse and possible undercoverage. All Wave 3 interview nonresponse bias analyses presented in this report are conditioning on Wave 1 participation, including the analyses discussed in Sections 4.2 and 5.2.

The "frame" information included Wave 1 demographic and socio-economic characteristics, and Wave 1 tobacco-use status. The estimates were based on all the Wave 1 participants who were eligible for the Wave 3 interview and were computed using the Wave 1 final weights (which were designed to reduce potential nonresponse bias from Wave 1).

Two sets of estimates were obtained from Wave 3 interview respondents. The first set of estimates was based on the Wave 1 final weights. Comparing this set of estimates to the "frame" data shows the representativeness of the Wave 3 responding sample before any statistical adjustment for attrition between Waves 1 and 3. The second set of estimates was based on the Wave 3 final weights that apply to all Wave 3 respondents regardless of their Wave 2 response status (referred to as "single-wave weights"). The Wave 3 single-wave weights were designed to reduce potential nonresponse bias due to attrition between Waves 1 and 3, so the second set of estimates shows the extent to which the statistical weighting adjustment might help reduce potential nonresponse bias at Wave 3. For reference, the terms "before Wave 3 weighting adjustment" and "after Wave 3 weighting adjustment" are used to refer to the two sets of estimates and comparisons in Sections 4 and 5. To facilitate interpretation of these two sets of estimates and comparisons, summary

descriptions of the PATH Study statistical weighting adjustments are provided in the next paragraphs.

Weighting adjustment is often used to account for differential response propensities across population subgroups. Among numerous sources, the Handbook on Household Surveys by the United Nations (2005, Chapter 6) and Särndal and Lundström (2005) discuss the methods and theory of using weight adjustments for nonresponse. For Wave 1, these adjustments were conducted at the household level and at the person level. The Wave 1 household-level weighting adjustments calibrated the estimates to household-level population estimates for census region and household composition and size from the 2013 ACS. Such weighting adjustments also correct for disparities among other characteristics that might be associated with the variables involved in the weighting adjustments. After accounting for household-level nonresponse, households with at least one person sampled for the PATH Study were identified, and each sampled person within a household was assigned the corresponding household weight with an adjustment to account for his/her within-household probability of selection. These weights were then adjusted to account for nonresponse to the Wave 1 Adult or Youth Interview or non-participation in the shadow youth recruitment. After this adjustment for nonresponse, the weights were calibrated using a raking process to person-level population estimates from the 2013 ACS. Outlier values of the sample weights were trimmed, and the weights were re-raked after any such trimming. More details about the PATH Study Wave 1 weight construction can be found in Section 5.1.1 of the PATH Study RUF User Guide.

For Wave 3, the approaches for creating the Adult Interview and Youth Interview single-wave weights were similar except that some auxiliary variables for nonresponse adjustment and raking differed by interview type. The final person-level weights assigned to Wave 1 respondents served as the initial weights for developing the single-wave weights for Wave 3 interview respondents. These weights were adjusted to account for nonresponse to the Wave 3 interview and the resulting weights were raked to control totals. Some of the control totals came from the 2013 ACS; others involving tobacco use were sample-based rather than population-based and reflected estimated Wave 1 population characteristics. Raking to sample-based control totals, often employed in longitudinal studies (see, for example, Brick, Lê, and West (2003)), can limit drifting in some important baseline characteristics that might arise through the applications of nonresponse adjustments over time. Lundström and Särndal (1999) provide theoretical discussions about sample-based calibration together with empirical evidence that such calibration can help reduce both variance and nonresponse bias. General discussions about the calibration method can be found in Särndal and Lundström (2005) and Särndal (2007). More details about the PATH Study Wave 3 weight construction appear in Section 5.1.3 of the PATH Study RUF User Guide.

3.2.3 Comparison to External Data Sources

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 national studies that ask about cigarette-smoking behavior. Possible differences were examined between the "after Wave 3 weighting adjustment" cigarette-smoking estimates from the PATH Study and independent estimates of those quantities from other studies (for the most similar timeframes for which data were available).

The external data sources included the Tobacco Use Supplement to the Current Population Survey 2014-2015 (TUS-CPS 2014-2015), the National Health Interview Survey 2016 (NHIS 2016), the National Health and Nutrition Examination Survey 2015-2016 (NHANES 2015-2016), the National Survey on Drug Use and Health 2016 (NSDUH 2016), and the National Youth Tobacco Survey 2016 (NYTS 2016). Appendix A describes the questions used to define current cigarette 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.

For both the PATH Study and the external data sources, item nonresponse was handled by excluding respondents with missing values for an item from the counts and estimates regarding that item. The proportions of item missingness were generally very low (less than 1 percent for adult estimates at the overall level and mostly less than 2 percent for youth estimates at the overall level) in both the PATH Study and the surveys that were used for comparison purposes.[2]

3.2.4 Analyses about Biospecimen Collections

Biospecimens provide a basis for the assessment of between-person differences and within-person changes over time in markers of tobacco exposure. They also allow for the detection of health conditions and disease processes potentially associated with the use of tobacco products. A subsample of Wave 3 Adult Interview respondents who provided a urine specimen in Wave 1 and/or Wave 2, were selected for Wave 3 urine collection. All first-time Adult Interview

[2] The proportion of item missingness for the NHANES youth data was slightly higher at 5.9 percent. However, note that the NSDUH 2016 pubic use files included only "usable" cases that met specified minimum item response requirements.

respondents in Wave 3 were asked to provide urine and blood specimens. Field interviewers collected the urine specimens; on separate visits, phlebotomists collected the blood specimens.

Unweighted response rates[3] were calculated, both overall and by subgroups, to assess the operational success of the urine and blood collections among the designated Wave 3 Adult Interview respondents. All Wave 3 biospecimen collection response rates presented in this report are conditioning on Wave 3 Adult Interview completion.

Demographic characteristics and Wave 3 tobacco-use status were compared between the first-time Adult Interview respondents and the biospecimen providers among them, separately for urine and blood. Estimates were based on Wave 3 final single-wave weights to evaluate potential bias due to nonresponse to biospecimen collections. All Wave 3 biospecimen collection nonresponse bias analyses presented in this report are conditioning on Wave 3 Adult Interview completion.

3.3 Estimation Method and Software Package

Fay's balanced repeated replication (BRR) method with a factor of 0.3 was used for variance estimation to account for the impact of the stratification and clustering involved in the PATH Study's sample design. SAS software version 9.4 was used to calculate all the point estimates. Confidence intervals were estimated using the modified Wilson approach (Wilson, 1927; SAS Institute, 2013). The preferred approach for testing whether two point estimates differ is to examine the confidence interval for the difference between the two point estimates; if the 95 percent confidence interval does not include zero, it can be concluded that the difference between the two estimates is statistically significant at the 0.05 significance level. This is discussed in Heeringa, West, and Berglund (2010, Section 5.6.1), for example. Another approach is to examine whether the confidence intervals for the two point estimates overlap; if the confidence intervals for two proportions do not overlap, then the difference between the two proportions is considered statistically significant. However, Schenker and Gentleman (2001) show that using the second approach results in a conservative test. For the analyses presented in this report, the first approach was used to compare all PATH Study estimates (in Sections 4.2, 5.2, and 6.2), and the second, more conservative approach was used to compare estimates between the PATH Study and external sources (in Sections 4.3 and 5.3). No adjustments were made for multiple comparisons because all

[3] Weighted response rates are not provided because the subset of adults asked to provide a urine specimen at Wave 3 does not represent a readily interpretable subpopulation. Similarly, while most first-time Adult Interview respondents were age 18 at Wave 3, some were older due to the time elapsed since their previous interview.

the statistical tests were based on pre-planned (i.e., not post-hoc) comparisons and are presented in this report.

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Wave 3 Adult Interview Nonresponse Bias Analysis Conditioning on Wave 1 Participation

4

This section discusses potential nonresponse bias (conditioning on Wave 1 participation) in estimates using the PATH Study's Wave 3 Adult Interview data. Section 4.1 describes how the Adult Interview response rates vary across various subgroups. Section 4.2 compares demographic and socio-economic characteristics, and tobacco-use status between Wave 3 Adult Interview respondents and those eligible for the Wave 3 Adult Interview. Section 4.3 compares estimates of adult cigarette use found by the PATH Study for Wave 3 to estimates based on other national studies.

4.1 Response Rates Conditioning on Wave 1 Participation

Unweighted and weighted response rates were calculated for the Wave 3 Adult Interview using the following formulas:

$$RR_A = C_A/(C_A + N_A + e \times U_A)$$

$$e_A = (C_A + N_A)/(C_A + N_A + IT_A)$$

where

RR_A = Wave 3 Adult Interview response rate;
C_A = number of Wave 3 Adult Interview complete cases;
N_A = number of Wave 3 Adult Interview nonrespondents known to be eligible;
U_A = number of Wave 3 Adult Interview nonrespondents with unknown eligibility status;
IT_A = number of Wave 3 Adult Interview ineligible cases that were not permanently ineligible at Wave 2; and
e_A = estimated proportion of eligible cases among the Wave 3 Adult Interview nonrespondents with unknown eligibility status.

Unweighted counts and weighted counts based on the Wave 1 IPS weights were obtained for response status categories C_A, N_A, U_A, and IT_A for unweighted response rates and weighted response rates, respectively. A small number of participants became permanently ineligible at

Wave 2 due to permanent incarceration, death, or having permanently moved overseas; this set of cases, denoted as IP_A in Table 4-1, were not included in the equation for computing e_A.

Table 4-1 provides response rates for the Wave 3 Adult Interview. In addition to the overall row, response rates are shown by Wave 1 sex, age, race/ethnicity, and tobacco-use status as well as by Wave 2 response status. Persons with missing values for a particular characteristic were excluded from the response rate calculation for that characteristic.

The unweighted and weighted response rates for the Wave 3 Adult Interview were 78.0 percent and 78.4 percent, respectively. For each subgroup (e.g., male), the unweighted and weighted response rates were similar. Table 4-1 shows moderately differential response rates across the various subgroups (e.g., male versus female). First, the weighted response rate was lower among males (76.4 percent) than among females (80.0 percent); this pattern is consistent with most household surveys (Groves and Couper, 1998; Stoop, 2005). Second, although it is generally harder to reach younger adults, the Wave 3 weighted response rates for those ages "under 18" and "18-24" in Wave 1 (82.1 percent and 75.8 percent, respectively) were comparable to those for older age groups (77.8 percent for "25-44," 80.3 percent for "45-64," and 77.2 percent for "65 and above"). Third, persons of non-Hispanic other or multiple races had a moderately lower weighted response rate (75.6 percent) than the other race/ethnicity groups (78.4 percent and higher); this could be partly because interviews were offered in only English and Spanish. Finally, regardless of the Wave 1 interview type (i.e., adult or youth), response rates did not vary substantially by Wave 1 tobacco-use status.

Variation in response rates by subgroups is to be expected in large-scale data collection efforts. None of the differences among the demographic and tobacco-use subgroups in Table 4-1 indicate potential nonresponse bias in the Wave 3 Adult Interview estimates.

The last three rows in Table 4-1 break out the Wave 3 response rates by Wave 2 response status. The weighted response rate was 91.3 percent among those who participated in Wave 2. In contrast, the Wave 3 weighted response rate was only 14.1 percent among those who did not participate in Wave 2.

Table 4-1. Wave 3 Adult Interview response rates conditioning on Wave 1 participation

Characteristic[a]	C_A: Completed (n)	IP_A: Permanently ineligible since Wave 2 (n)	IT_A: Ineligible but not permanently ineligible at Wave 2 (n)	N_A: Nonresponse known to be eligible (n)	U_A: Nonresponse with unknown eligibility status (n)	RR_A: Unweighted response rate (%)	RR_A: Weighted response rate (%)
Overall	28,148	187	436	5,192	2,781	78.0	78.4
Wave 1 sex							
Male	13,789	118	267	2,801	1,546	76.1	76.4
Female	14,334	68	168	2,385	1,230	79.9	80.0
Wave 1 age group							
Under 18	3,621	1	23	543	236	82.3	82.1
18-24	6,798	5	92	1,304	911	75.5	75.8
25-44	8,598	23	120	1,596	931	77.4	77.8
45-64	6,878	77	108	1,245	510	79.7	80.3
65 and above	2,249	81	93	499	188	76.8	77.2
Wave 1 race/ethnicity							
Hispanic	5,244	13	77	804	611	78.8	78.6
Non-Hispanic White alone	16,274	129	237	3,374	1,482	77.1	78.4
Non-Hispanic Black alone	4,083	27	71	509	393	82.0	80.5
Non-Hispanic other race or multiple races	2,111	10	39	403	253	76.4	75.6
Wave 1 current established tobacco use[b] (Wave 1 adults only)							
Current established tobacco user	10,785	102	230	2,022	1,230	77.0	77.0
Not current established tobacco user	13,074	73	159	2,459	1,247	78.0	79.0
Wave 1 ever tobacco use (Wave 1 youth only)							
Ever user	1,324	0	11	178	120	81.7	81.7
Never user	2,226	1	12	342	107	83.2	82.9

Table 4-1. Wave 3 Adult Interview response rates conditioning on Wave 1 participation (continued)

Characteristic[a]	C_A: Completed (n)	IP_A: Permanently ineligible since Wave 2 (n)	IT_A: Ineligible but not permanently ineligible at Wave 2 (n)	N_A: Nonresponse known to be eligible (n)	U_A: Nonresponse with unknown eligibility status (n)	RR_A: Unweighted response rate (%)	RR_A: Weighted response rate (%)
Wave 2 response status							
Respondent	27,121	0	261	1,944	931	90.4	91.3
Other	1,027	187	175	3,248	1,850	17.0	14.1

[a] For each Wave 1 characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] A tobacco user is defined as someone who uses one or more of the tobacco products covered by the Wave 1 Adult Interview. A 'current established user' of a given tobacco product is someone who currently uses the product every day or some days and: for cigarettes, has smoked at least 100 cigarettes in their lifetime and, for any other tobacco product, has reported they ever used that product regularly. The products covered by the Wave 1 Adult Interview are cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, e-cigarettes, and dissolvable tobacco.

[c] An 'ever user' is someone who has ever used one or more of the tobacco products covered by the Wave 1 Youth Interview. A 'never user' is someone who has never used any of those tobacco products. Ever use of a tobacco product is defined as having ever used the product, even one or two times. The products covered by the Wave 1 Youth Interview are cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, e-cigarettes, dissolvable tobacco, bidis, and kreteks.

4.2 Comparison between Wave 3 Respondents and Those Eligible for Wave 3 Interview

This section compares weighted estimates between the Wave 3 Adult Interview respondents and the Wave 1 participants who were eligible for the Wave 3 Adult Interview. The weighted estimates cover demographic and socio-economic characteristics (shown in Table 4-2) as well as tobacco-use status (shown in Tables 4-3 and 4-4).

Section 3.2.2 describes the methods used for obtaining the results in Tables 4-2, 4-3, and 4-4. Each table shows two sets of comparisons between the Wave 3 Adult Interview respondents and those eligible for the Wave 3 Adult Interview. The first set is for the "before Wave 3 weighting adjustment" comparison, and the second set is for the "after Wave 3 weighting adjustment" comparison.

Table 4-2 compares some Wave 1 demographic and socio-economic characteristics between the Wave 3 Adult Interview respondents and those eligible for the Wave 3 Adult Interview. For each characteristic, the percentages sum to 100 percent over the categories associated with the characteristic. For example, for both the Wave 3 respondents and those eligible for the Wave 3 Adult Interview, the estimated percentage of males and the estimated percentage of females add to 100 percent. Although the confidence intervals for some estimated differences in the first set of comparisons in Table 4-2 did not include zero, [4] most of the differences between the Wave 3 respondents and those eligible for the Wave 3 Adult Interview were not large enough to be substantively meaningful. The only noticeable underrepresentation among the Wave 3 adult respondents was the male population, which tends to have lower response propensity than the female population in most household surveys (Groves and Couper, 1998; Stoop, 2005).

For the second set of comparisons in Table 4-2, the "after Wave 3 weighting adjustment" estimates based on the Wave 3 respondents aligned almost perfectly with the estimates based on those eligible for the Wave 3 Adult Interview. That is, the estimated differences in the last column of Table 4-2 were all zero (to one decimal place) and the confidence intervals all included or were in the proximity of zero. This is because during the Wave 3 raking process, the control totals accounted for estimated population characteristics based on the PATH Study Wave 1 interview data including age, sex, race, ethnicity, education, and tobacco-use status.

[4] Testing whether or not a 100(1-α) percent confidence interval for a difference between two population proportions includes zero is equivalent to a two-sided test of the null hypothesis that the difference is zero at the α significance level (see, for example, Hanushek and Jackson, 1977).

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Table 4-2. Comparison of Wave 1 demographic and socio-economic characteristics between Wave 3 Adult Interview respondents and Wave 1 participants who were eligible for Wave 3 Adult Interview

Wave 1 characteristic	Wave 1 participants who were eligible for Wave 3 Adult Interview		Wave 3 Adult Interview respondents				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
	Unweighted count	Weighted percentage, using Wave 1 final weights [95% confidence interval]	Unweighted count	Weighted percentage, using Wave 1 final weights [95% confidence interval]	Difference in weighted percentages [Wave 3 – Wave 1] [95% confidence interval]	Weighted percentage, using Wave 3 final weights [95% confidence interval]	Difference in weighted percentages [Wave 3 – Wave 1] [95% confidence interval]
Sex							
Male	18,136	48.0% [47.4%, 48.5%]	13,789	46.8% [46.3%, 47.4%]	-1.1% [-1.6%, -0.7%]	48.0% [47.4%, 48.5%]	0.0% [-0.0%, 0.0%]
Female	17,949	52.0% [51.5%, 52.6%]	14,334	53.2% [52.6%, 53.7%]	1.1% [0.7%, 1.6%]	52.0% [51.5%, 52.6%]	0.0% [-0.0%, 0.0%]
Age group							
Under 18	4,400	3.4% [3.2%, 3.6%]	3,621	3.6% [3.4%, 3.8%]	0.2% [0.1%, 0.3%]	3.4% [3.2%, 3.6%]	-0.0% [-0.0%, -0.0%]
18-24	9,013	12.7% [12.3%, 13.0%]	6,798	12.3% [11.9%, 12.7%]	-0.4% [-0.6%, -0.1%]	12.7% [12.3%, 13.1%]	0.0% [0.0%, 0.0%]
25-44	11,125	33.4% [32.9%, 33.9%]	8,598	33.1% [32.5%, 33.6%]	-0.3% [-0.7%, 0.0%]	33.4% [32.8%, 33.9%]	0.0% [-0.0%, 0.0%]
45-64	8,633	33.5% [33.0%, 34.0%]	6,878	34.3% [33.7%, 34.8%]	0.8% [0.4%, 1.2%]	33.5% [33.0%, 34.1%]	0.0% [0.0%, 0.1%]
65 and above	2,936	17.0% [16.6%, 17.4%]	2,249	16.7% [16.3%, 17.2%]	-0.3% [-0.7%, 0.1%]	17.0% [16.6%, 17.5%]	0.0% [-0.1%, 0.0%]
Race/ethnicity							
Hispanic	6,659	15.5% [15.2%, 15.9%]	5,244	15.5% [15.1%, 15.9%]	0.0% [-0.4%, 0.3%]	15.5% [15.1%, 15.9%]	0.0% [-0.1%, 0.0%]
Non-Hispanic White alone	21,130	65.6% [65.1%, 66.1%]	16,274	65.7% [65.1%, 66.2%]	0.1% [-0.3%, 0.5%]	65.6% [65.0%, 66.2%]	0.0% [-0.1%, 0.1%]

Table 4-2. Comparison of Wave 1 demographic and socio-economic characteristics between Wave 3 Adult Interview respondents and Wave 1 participants who were eligible for Wave 3 Adult Interview (continued)

Wave 1 characteristic	Wave 1 participants who were eligible for Wave 3 Adult Interview		Wave 3 Adult Interview respondents				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
	Unweighted count	Weighted percentage, using Wave 1 final weights [95% confidence interval]	Unweighted count	Weighted percentage, using Wave 1 final weights [95% confidence interval]	Difference in weighted percentages [Wave 3 – Wave 1] [95% confidence interval]	Weighted percentage, using Wave 3 final weights [95% confidence interval]	Difference in weighted percentages [Wave 3 – Wave 1] [95% confidence interval]
Race/ethnicity (continued)							
Non-Hispanic Black alone	4,985	11.3% [11.0%, 11.6%]	4,083	11.6% [11.2%, 12.0%]	0.3% [0.1%, 0.5%]	11.3% [10.9%, 11.6%]	0.0% [-0.1%, 0.0%]
Non-Hispanic other race or multiple races	2,767	7.6% [7.3%, 7.9%]	2,111	7.2% [6.9%, 7.6%]	-0.4% [-0.6%, -0.1%]	7.7% [7.3%, 8.0%]	0.0% [-0.0%, 0.1%]
Education							
Less than high school or GED	6,242	16.5% [16.1%, 16.9%]	4,872	16.3% [15.8%, 16.8%]	-0.2% [-0.5%, 0.1%]	16.5% [16.0%, 16.9%]	0.0% [-0.1%, 0.0%]
High school	7,402	24.2% [23.7%, 24.7%]	5,626	23.6% [23.1%, 24.1%]	-0.6% [-1.0%, -0.2%]	24.2% [23.6%, 24.7%]	0.0% [-0.1%, 0.0%]
Some college, no degree	11,156	31.2% [30.7%, 31.7%]	8,627	31.2% [30.6%, 31.8%]	0.0% [-0.3%, 0.4%]	31.2% [30.7%, 31.8%]	0.0% [-0.0%, 0.1%]
Bachelor degree and above	6,720	28.1% [27.6%, 28.6%]	5,281	28.9% [28.3%, 29.4%]	0.8% [0.3%, 1.2%]	28.1% [27.6%, 28.7%]	0.0% [-0.0%, 0.1%]
Health insurance							
Yes	25,302	85.5% [84.9%, 86.1%]	19,682	85.8% [85.1%, 86.4%]	0.3% [0.0%, 0.6%]	85.5% [84.9%, 86.1%]	0.0% [-0.2%, 0.3%]
No	6,023	14.5% [13.9%, 15.1%]	4,595	14.2% [13.6%, 14.9%]	-0.3% [-0.6%, -0.0%]	14.5% [13.9%, 15.1%]	0.0% [-0.3%, 0.2%]

Tables 4-3 and 4-4 show the comparisons for the Wave 1 tobacco-use measures between Wave 3 Adult Interview respondents and those eligible for the Wave 3 Adult Interview. The Wave 1 participants who were eligible for the Wave 3 Adult Interview were divided into two groups based on their Wave 1 interview type (i.e., adult versus youth) and analyzed separately. Table 4-3 covers "current established tobacco use" for the Wave 1 Adult Interview respondents and Table 4-4 covers "ever tobacco use" for the Wave 1 Youth Interview respondents. Besides the overall estimates, these tables also show the estimated Wave 1 "current established use" and "ever use" rates for some demographic subgroups.

For the "before Wave 3 weighting adjustment" estimates, the differences between the Wave 3 respondents and those eligible for the Wave 3 Adult Interview were no more than 1.2 percentage points. In addition, all the confidence intervals either included or were in the proximity of zero. For the "after Wave 3 weighting adjustment" estimates, the differences between the respondents and those eligible for the Adult Interview were all negligible, with the exception of the "ever tobacco use" measure for non-Hispanic Black alone adults who were youth in Wave 1 (see Table 4-4).[5] Overall, these results reflect the use of both demographic variables and tobacco-use measures from Wave 1 for calibrating the Wave 3 interview weights.

Assuming that the Wave 1 demographic, socio-economic, and tobacco-use characteristics in Tables 4-2, 4-3, and 4-4 are correlated with key tobacco and health related outcome measures in Wave 3 of the PATH Study, these results indicate little if any nonresponse bias in the Adult Interview estimates due to attrition from Wave 1 to Wave 3.

[5] For this particular subgroup, the sample sizes are relatively small and the difference in estimates is only 1.6 percentage points.

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Table 4-3. Comparison of Wave 1 "current established tobacco-use" estimates between Wave 1 adults who completed Wave 3 Adult Interview and Wave 1 adults who were eligible for Wave 3 Adult Interview*

	Wave 1 adults who were eligible for Wave 3 Adult Interview		Wave 3 Adult Interview respondents who completed Wave 1 Adult Interview				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
Wave 1 characteristic[a]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]	Weighted estimate, using Wave 3 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]
Overall	30,817	23.8% [23.2%, 24.4%]	23,859	23.3% [22.6%, 24.0%]	-0.5% [-0.8%, -0.2%]	23.7% [23.1%, 24.3%]	-0.1% [-0.1%, -0.0%]
Sex							
Male	15,504	29.7% [28.8%, 30.5%]	11,670	28.7% [27.7%, 29.8%]	-0.9% [-1.4%, -0.5%]	29.5% [28.7%, 30.4%]	-0.2% [-0.3%, -0.0%]
Female	15,288	18.4% [17.7%, 19.1%]	12,169	18.5% [17.7%, 19.3%]	0.1% [-0.2%, 0.4%]	18.4% [17.7%, 19.1%]	0.0% [-0.0%, 0.0%]
Age group							
18-24	8,869	29.0% [27.6%, 30.4%]	6,696	28.2% [26.6%, 29.8%]	-0.8% [-1.4%, -0.2%]	28.9% [27.5%, 30.3%]	-0.1% [-0.1%, 0.0%]
25-44	10,901	28.9% [27.9%, 29.8%]	8,431	28.4% [27.3%, 29.5%]	-0.5% [-1.0%, 0.1%]	28.7% [27.7%, 29.7%]	-0.1% [-0.5%, 0.2%]
45-64	8,311	23.0% [22.1%, 24.0%]	6,632	22.5% [21.5%, 23.6%]	-0.5% [-0.9%, -0.1%]	23.0% [22.0%, 24.0%]	-0.1% [-0.4%, 0.3%]
65 and above	2,725	10.7% [9.6%, 11.9%]	2,096	10.3% [9.1%, 11.7%]	-0.4% [-0.9%, 0.1%]	10.7% [9.4%, 12.1%]	0.0% [-0.5%, 0.5%]
Race/ethnicity							
Hispanic	5,250	17.4% [16.4%, 18.4%]	4,088	17.4% [16.2%, 18.6%]	0.0% [-0.5%, 0.5%]	17.4% [16.2%, 18.5%]	0.0% [-0.1%, 0.1%]
Non-Hispanic White alone	18,513	25.3% [24.4%, 26.2%]	14,224	24.2% [23.2%, 25.2%]	-1.1% [-1.4%, -0.8%]	25.2% [24.3%, 26.1%]	-0.1% [-0.2%, 0.0%]

Table 4-3. Comparison of Wave 1 "current established tobacco-use" estimates between Wave 1 adults who completed Wave 3 Adult Interview and Wave 1 adults who were eligible for Wave 3 Adult Interview* (continued)

	Wave 1 adults who were eligible for Wave 3 Adult Interview		Wave 3 Adult Interview respondents who completed Wave 1 Adult Interview				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
Wave 1 characteristic[a]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]	Weighted estimate, using Wave 3 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]
Race/ethnicity (continued)							
Non-Hispanic Black alone	4,275	26.8% [25.5%, 28.2%]	3,462	28.1% [26.3%, 29.9%]	1.2% [0.4%, 2.0%]	26.9% [25.4%, 28.4%]	0.1% [-0.2%, 0.3%]
Non-Hispanic other race or multiple races	2,313	19.4% [17.8%, 21.0%]	1,738	19.2% [17.4%, 21.1%]	-0.2% [-1.4%, 0.9%]	19.1% [17.3%, 21.0%]	-0.3% [-1.0%, 0.4%]

* A tobacco user is defined as someone who uses one or more of the tobacco products covered by the Wave 1 Adult Interview. A 'current established user' of a given tobacco product is someone who currently uses the product every day or some days and for cigarettes, has smoked at least 100 cigarettes in their lifetime and, for any other tobacco product, has reported they ever used that product regularly. The products covered by the Wave 1 Adult Interview are cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, e-cigarettes, and dissolvable tobacco.

[a] For each Wave 1 characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

Table 4-4. Comparison of Wave 1 "ever tobacco-use" estimates between Wave 1 youth who completed Wave 3 Adult Interview and Wave 1 youth who were eligible for Wave 3 Adult Interview*

	Wave 1 youth who were eligible for Wave 3 Adult Interview		Wave 3 Adult Interview respondents who completed Wave 1 Youth Interview				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
Wave 1 characteristic[a]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]	Weighted estimate, using Wave 3 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]
Overall	4,297	37.5% [35.7%, 39.4%]	3,550	37.2% [35.2%, 39.3%]	-0.3% [-1.0%, 0.5%]	37.8% [35.9%, 39.7%]	0.2% [-0.0%, 0.5%]
Sex							
Male	2,137	40.4% [38.1%, 42.7%]	1,768	40.8% [38.4%, 43.3%]	0.4% [-0.6%, 1.4%]	40.7% [38.4%, 43.0%]	0.3% [-0.1%, 0.7%]
Female	2,155	34.7% [32.3%, 37.1%]	1,779	33.7% [31.0%, 36.4%]	-1.0% [-2.1%, 0.1%]	34.9% [32.4%, 37.4%]	0.2% [-0.1%, 0.5%]
Race/ethnicity							
Hispanic	1,175	38.3% [34.7%, 42.1%]	983	37.3% [33.0%, 41.8%]	-1.0% [-2.4%, 0.4%]	38.2% [34.2%, 42.4%]	-0.1% [-1.1%, 0.8%]
Non-Hispanic White alone	2,151	40.1% [37.4%, 42.8%]	1,719	40.0% [37.1%, 43.0%]	-0.1% [-1.2%, 1.0%]	40.1% [37.4%, 42.9%]	0.0% [-0.4%, 0.4%]
Non-Hispanic Black alone	562	31.4% [27.6%, 35.4%]	497	31.9% [27.9%, 36.3%]	0.6% [-0.8%, 2.0%]	33.0% [29.0%, 37.3%]	1.6% [0.4%, 2.9%]
Non-Hispanic other race or multiple races	374	28.5% [24.2%, 33.3%]	318	28.4% [23.8%, 33.6%]	-0.1% [-2.2%, 2.0%]	28.5% [23.8%, 33.7%]	0.0% [-1.9%, 1.9%]

* An 'ever user' is someone who has ever used one or more of the tobacco products covered by the Wave 1 Youth Interview. A 'never user' is someone who has never used any of those tobacco products. Ever use of a tobacco product is defined as having ever used the product, even one or two times. The products covered by the Wave 1 Youth Interview are cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, e-cigarettes, dissolvable tobacco, bidis, and kreteks.

[a] For each Wave 1 characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

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4.3 Comparison of Cigarette-Smoking Estimates between the PATH Study and Other National Studies

This section compares adult cigarette-smoking estimates based on Wave 3 of the PATH Study to similar estimates based on data from the TUS-CPS 2014-2015, NHIS 2016, NHANES 2015-2016, and NSDUH 2016.

Table 4-5 presents estimates of the prevalence of current cigarette smoking[6] based on the Wave 3 Adult Interview, for the adult population as a whole and for subgroups. These estimates are accompanied by 95 percent confidence intervals. The point estimates for the PATH Study were calculated using the Wave 3 final single-wave weights. The corresponding replicate weights were used to calculate variances and confidence intervals. Point estimates and 95 percent confidence intervals are reported for the other national studies as well.

Table 4-5 indicates that the PATH Study "after Wave 3 weighting adjustment" estimates of adult current cigarette-smoking rates were similar to estimates from NHANES 2015-2016; these two studies had overlapping confidence intervals for almost all the estimates in the table. Estimates from TUS-CPS 2014-2015 and NHIS 2016 tended to be lower than those from Wave 3 of the PATH Study and NHANES 2015-2016, while estimates from NSDUH 2016 tended to be higher than those from Wave 3 of the PATH Study and NHANES 2015-2016. Table 4-5 shows no evidence of nonresponse bias in the PATH Study with respect to current cigarette-smoking behavior among adults, in the sense that the PATH Study's estimates were all within the range of estimates from comparable surveys.

It is important to note that many potential reasons can explain the disparities in Table 4-5. In addition to the varying degrees of sampling and measurement errors, the surveys also differ in question order, context, mode of administration, and year of data collection. The TUS-CPS estimates of smoking prevalence are generally lower than estimates from the other surveys, which may be due 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 audio computer-assisted self-interview (ACASI) administration for the tobacco-use questions so that the interviewer does not see responses to the questions. In contrast, TUS-CPS, NHIS, and NHANES

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

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 uses a longitudinal cohort design to assess within-person changes 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 4-5. Comparison of adult cigarette-smoking estimates from PATH Study Wave 3 Adult Interview and other national studies*

Wave 3 outcome variable and subgroup	Subgroup sample size	PATH Study: Weighted estimate, using Wave 3 final weights [95% confidence interval]	Estimate from TUS-CPS 2014-2015 [95% confidence interval]	Estimate from NHIS 2016 [95% confidence interval]	Estimate from NHANES 2015-2016 [95% confidence interval]	Estimate from NSDUH 2016, original definition[a] [95% confidence interval]	Estimate from NSDUH 2016, modified definition[a] [95% confidence interval]
Current smoker, overall	28,122	18.3% [17.7%, 18.9%]	13.7% [13.5%, 13.9%]	15.5% [14.8%, 16.1%]	18.5% [16.6%, 20.4%]	20.7% [20.0%, 21.3%]	19.1% [18.5%, 19.7%]
Current smoker, male	13,773	20.5% [19.8%, 21.2%]	15.4% [15.1%, 15.7%]	17.5% [16.6%, 18.5%]	21.3% [18.7%, 24.2%]	22.8% [22.0%, 23.6%]	21.1% [20.3%, 21.8%]
Current smoker, female	14,323	16.3% [15.6%, 17.0%]	12.2% [11.9%, 12.5%]	13.5% [12.8%, 14.3%]	15.8% [14.4%, 17.4%]	18.7% [17.8%, 19.6%]	17.2% [16.4%, 18.1%]
Current smoker, age 18-24	8,448	16.6% [15.6%, 17.6%]	13.0% [12.2%, 13.8%]	13.1% [11.5%, 14.9%]	17.9% [14.1%, 22.4%]	N/A	N/A
Current smoker, age 25-44	9,788	23.3% [22.3%, 24.3%]	15.4% [15.0%, 15.7%]	17.6% [16.5%, 18.7%]	21.5% [19.2%, 24.0%]	N/A	N/A
Current smoker, age 45-64	7,183	19.7% [18.8%, 20.6%]	15.8% [15.4%, 16.1%]	18.0% [17.0%, 19.1%]	21.3% [18.8%, 24.0%]	N/A	N/A
Current smoker, age 65 and above	2,701	8.5% [7.5%, 9.6%]	7.5% [7.2%, 7.9%]	8.8% [8.0%, 9.7%]	8.6% [5.9%, 12.5%]	N/A	N/A
Current smoker, Hispanic	5,239	14.2% [13.2%, 15.3%]	9.1% [8.6%, 9.6%]	10.7% [9.3%, 12.4%]	15.7% [13.8%, 17.8%]	16.4% [15.0%, 18.0%]	13.7% [12.5%, 15.0%]
Current smoker, Non-Hispanic White alone	16,265	19.0% [18.3%, 19.8%]	15.0% [14.8%, 15.3%]	16.6% [15.9%, 17.4%]	18.3% [15.5%, 21.5%]	22.1% [21.3%, 22.9%]	20.9% [20.1%, 21.7%]
Current smoker, Non-Hispanic Black alone	4,072	22.4% [21.0%, 23.9%]	14.7% [14.0%, 15.4%]	16.5% [14.8%, 18.4%]	23.5% [21.1%, 26.0%]	21.6% [20.3%, 22.9%]	19.3% [18.0%, 20.6%]
Current smoker, Non-Hispanic other race or multiple races	2,110	13.6% [12.2%, 15.1%]	10.7% [10.1%, 11.4%]	14.0% [12.2%, 15.9%]	18.1% [13.0%, 24.6%]	16.3% [14.2%, 18.5%]	14.6% [12.6%, 16.8%]
Current every-day smoker, overall	28,133	14.1% [13.6%, 14.6%]	10.6% [10.4%, 10.8%]	11.8% [11.2%, 12.4%]	14.2% [12.4%, 16.1%]	N/A	N/A

Table 4-5. Comparison of adult cigarette-smoking estimates from PATH Study Wave 3 Adult Interview and other national studies* (continued)

Wave 3 outcome variable and subgroup	Subgroup sample size	PATH Study: Weighted estimate, using Wave 3 final weights [95% confidence interval]	Estimate from TUS-CPS 2014-2015 [95% confidence interval]	Estimate from NHIS 2016 [95% confidence interval]	Estimate from NHANES 2015-2016 [95% confidence interval]	Estimate from NSDUH 2016, original definition[a] [95% confidence interval]	Estimate from NSDUH 2016, modified definition[a] [95% confidence interval]
Current some-days smoker, overall	28,124	4.2% [4.0%, 4.4%]	3.1% [3.0%, 3.2%]	3.7% [3.4%, 4.0%]	4.3% [3.6%, 5.1%]	N/A	N/A

* Estimates from all the other national studies were obtained using public use files for those surveys. The modified Wilson confidence interval approach was used to compute the 95 percent confidence intervals for all the point estimates in the table.

[a] 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. Detailed age information was not available in the public use file for NSDUH 2016.

Wave 3 Youth Interview Nonresponse Bias Analysis Conditioning on Wave 1 Participation

5

This section discusses potential nonresponse bias (conditioning on Wave 1 participation) in estimates using the PATH Study's Wave 3 Youth Interview data. Section 5.1 describes how the Youth Interview response rates vary across various subgroups. Section 5.2 compares demographic characteristics and tobacco-use status between Wave 3 Youth Interview respondents and those eligible for the Wave 3 Youth Interview. Section 5.3 compares estimates of youth cigarette use found by the PATH Study for Wave 3 to estimates based on other national studies.

5.1 Response Rates Conditioning on Wave 1 Participation

Unweighted and weighted response rates were calculated for the Wave 3 Youth Interview using the following formulas:

$$RR_Y = C_Y/(C_Y + N_Y + e_Y \times U_Y)$$

$$e_Y = (C_Y + N_Y)/(C_Y + N_Y + IT_Y)$$

where

RR_Y = Wave 3 Youth Interview response rate;
C_Y = number of Wave 3 Youth Interview complete cases;
N_Y = number of Wave 3 Youth Interview nonrespondents known to be eligible;
U_Y = number of Wave 3 Youth Interview nonrespondents with unknown eligibility status;
IT_Y = number of Wave 3 Youth Interview ineligible cases that were not permanently ineligible at Wave 2; and
e_Y = estimated proportion of eligible cases among the Wave 3 Youth Interview nonrespondents with unknown eligibility status.

Unweighted and weighted counts based on the Wave 1 IPS weights were obtained for response status categories C_Y, N_Y, U_Y, and IT_Y for unweighted response rates and weighted response rates, respectively. A small number of participants became permanently ineligible at Wave 2 due to

permanent incarceration, death, or having permanently moved overseas; this set of cases, denoted as IP_Y in Table 5-1, were not included in the equation for computing e_Y.

Table 5-1 provides response rates for the Wave 3 Youth Interview. As in Table 4-1 (for the Adult Interview), in addition to the overall row, Youth Interview response rates are shown by Wave 1 sex, age, race/ethnicity, and tobacco-use status as well as by Wave 2 response status. Persons with missing values for a particular characteristic were excluded from the response rate calculation for that characteristic.

The unweighted and weighted response rates for the Wave 3 Youth Interview were both 83.3 percent, and the unweighted and weighted response rates for each subgroup were very similar. The response rates varied little or only moderately (i.e., by no more than 2.3 percent) by Wave 1 sex and race/ethnicity. However, for age, the weighted response rate for the "under 12" age group[7] (80.2 percent) was noticeably lower than for the "12-13" and "14-17" age groups (84.8 percent and 85.1 percent, respectively). This is likely because the persons in the "under 12" age group were shadow youth at Wave 1, so for some of them the Wave 3 Youth Interview was the first PATH Study interview they were asked to complete. (The Wave 2 weighted response rate was also lower among youth who were shadow youth at Wave 1 (82.1 percent) than among those who had completed a Youth Interview at Wave 1 (88.4 percent).) For tobacco use, the weighted response rate among Wave 1 youth was lower for the Wave 1 "ever user" group than for the Wave 1 "never user" group.[8] Similar to the Adult Interview, the Wave 3 Youth Interview response rates also differed substantially between Wave 2 participants and Wave 2 non-participants.

As mentioned in Section 4.1, variation in response rates by subgroups is to be expected in large-scale data collection efforts. None of the differences among the demographic and tobacco-use subgroups in Table 5-1 indicate potential nonresponse bias in the Wave 3 Youth Interview estimates.

[7] Note that the age groups reflect age at Wave 1.

[8] Cunradi et al. (2005) and Young et al. (2006) have found that smokers were less likely to be retained in subsequent waves of surveys than nonsmokers.

Table 5-1. Wave 3 Youth Interview response rates conditioning on Wave 1 participation

Characteristic[a]	C_Y: Completed (n)	IP_Y: Permanently ineligible since Wave 2 (n)	IT_Y: Ineligible but not permanently ineligible at Wave 2 (n)	N_Y: Nonresponse known to be eligible (n)	U_Y: Nonresponse with unknown eligibility status (n)	RR_Y: Unweighted response rate (%)	RR_Y: Weighted response rate (%)
Overall	11,814	4	27	1,742	636	83.3	83.3
Wave 1 sex							
Male	6,105	3	17	905	331	83.2	83.3
Female	5,687	1	9	829	301	83.4	83.5
Wave 1 age group							
Under 12	3,992	1	9	754	239	80.1	80.2
12-13	3,963	2	8	507	203	84.8	84.8
14-17	3,859	1	10	481	193	85.1	85.1
Wave 1 race/ethnicity							
Hispanic	3,466	2	10	411	235	84.3	84.4
Non-Hispanic White alone	5,482	0	6	967	218	82.2	82.4
Non-Hispanic Black alone	1,591	2	4	179	112	84.5	84.3
Non-Hispanic other race or multiple races	1,083	0	4	160	62	83.0	83.0
Wave 1 ever tobacco use[b] (Wave 1 youth only)							
Ever user	1,011	1	8	133	82	82.5	82.6
Never user	6,459	2	9	794	294	85.6	85.6
Wave 2 response status							
Respondent	11,440	0	13	761	273	91.7	91.8
Other	374	4	14	981	363	21.8	22.1

[a] For each Wave 1 characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] An 'ever user' is someone who has ever used one or more of the tobacco products covered by the Wave 1 Youth Interview. A 'never user' is someone who has never used any of those tobacco products. Ever use of a tobacco product is defined as having ever used the product, even one or two times. The products covered by the Wave 1 Youth Interview are cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, e-cigarettes, dissolvable tobacco, bidis, and kreteks.

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5.2 Comparison between Wave 3 Respondents and Those Eligible for Wave 3 Interview

This section compares weighted estimates between the Wave 3 Youth Interview respondents and the Wave 1 participants who were eligible for the Wave 3 Youth Interview. The weighted estimates cover demographic characteristics (shown in Table 5-2) and tobacco-use status (shown in Table 5-3). The structure of these tables is essentially the same as the tables in Section 4.2 for the Adult Interview.

Table 5-2 compares some Wave 1 demographic characteristics between the Wave 3 Youth Interview respondents and those eligible for the Wave 3 Youth Interview. As in Table 4-2, the percentages sum to 100 percent over the categories associated with each characteristic in Table 5-2. For sex and race/ethnicity, the "before Wave 3 weighting adjustment" distributions among the Wave 3 Youth Interview respondents were almost the same as the distributions among those eligible for the Wave 3 Youth Interview. As described in Section 5.1, the notable underrepresentation among respondents was in the Wave 1 "under 12" age group. For the "after Wave 3 weighting adjustment" differences, the estimated confidence intervals (in the last column of Table 5-2) either included zero or were in the proximity of zero.

Tables 5-3 shows the comparison of Wave 1 "ever tobacco-use" rates between Wave 1 Youth Interview respondents who completed the Wave 3 Youth Interview and all the Wave 1 Youth Interview respondents eligible for the Wave 3 Youth Interview. Table 5-3 includes a subset of the youth in Table 5-2 because there are no Wave 1 interview data for the Wave 3 Youth Interview respondents who were shadow youth at Wave 1. For both the "before Wave 3 weighting adjustment" and the "after Wave 3 weighting adjustment" estimates, differences between respondents and those eligible for the interview were no more than 0.8 of a percentage point. In addition, the confidence intervals either included zero or were in the proximity of zero.

Assuming that the Wave 1 demographic and tobacco-use characteristics in Tables 5-2 and 5-3 are correlated with key tobacco and health related outcome measures in Wave 3 of the PATH Study, these results indicate little if any nonresponse bias in the Youth Interview estimates due to attrition from Wave 1 to Wave 3.

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Table 5-2. Comparison of Wave 1 demographic characteristics between Wave 3 Youth Interview respondents and Wave 1 participants who were eligible for Wave 3 Youth Interview

Wave 1 characteristic	Wave 1 participants who were eligible for Wave 3 Youth Interview		Wave 3 Youth Interview respondents				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
	Unweighted count	Weighted percentage, using Wave 1 final weights [95% confidence interval]	Unweighted count	Weighted percentage, using Wave 1 final weights [95% confidence interval]	Difference in weighted percentages [Wave 3 – Wave 1] [95% confidence interval]	Weighted percentage, using Wave 3 final weights [95% confidence interval]	Difference in weighted percentages [Wave 3 – Wave 1] [95% confidence interval]
Sex							
Male	7,341	51.3% [50.5%, 52.2%]	6,105	51.3% [50.4%, 52.2%]	-0.1% [-0.5%, 0.3%]	51.4% [50.5%, 52.3%]	0.0% [-0.1%, 0.1%]
Female	6,817	48.7% [47.8%, 49.5%]	5,687	48.7% [47.8%, 49.6%]	0.1% [-0.3%, 0.5%]	48.6% [47.7%, 49.5%]	0.0% [-0.1%, 0.1%]
Age group							
Under 12	4,985	33.4% [32.6%, 34.2%]	3,992	32.2% [31.3%, 33.0%]	-1.2% [-1.6%, -0.8%]	33.0% [32.2%, 33.8%]	-0.4% [-0.5%, -0.3%]
12-13	4,673	33.7% [32.9%, 34.5%]	3,963	34.2% [33.4%, 35.1%]	0.6% [0.2%, 0.9%]	33.7% [32.9%, 34.6%]	0.1% [0.0%, 0.1%]
14-17	4,533	32.9% [32.2%, 33.7%]	3,859	33.6% [32.7%, 34.4%]	0.6% [0.3%, 1.0%]	33.3% [32.4%, 34.1%]	0.3% [0.2%, 0.4%]
Race/ethnicity							
Hispanic	4,112	23.3% [22.6%, 24.0%]	3,466	23.6% [22.8%, 24.4%]	0.3% [-0.1%, 0.7%]	23.4% [22.7%, 24.2%]	0.1% [0.0%, 0.2%]
Non-Hispanic White alone	6,667	53.6% [52.8%, 54.4%]	5,482	53.1% [52.2%, 54.0%]	-0.5% [-1.0%, -0.0%]	53.6% [52.7%, 54.5%]	0.0% [-0.1%, 0.1%]
Non-Hispanic Black alone	1,882	13.6% [13.0%, 14.2%]	1,591	13.8% [13.1%, 14.4%]	0.2% [-0.2%, 0.5%]	13.5% [12.9%, 14.2%]	-0.1% [-0.1%, 0.0%]
Non-Hispanic other race or multiple races	1,305	9.5% [9.0%, 10.0%]	1,083	9.5% [9.0%, 10.1%]	0.1% [-0.2%, 0.3%]	9.5% [9.0%, 10.0%]	0.0% [-0.1%, 0.1%]

Table 5-3. Comparison of Wave 1 "ever tobacco-use" estimates between Wave 1 youth who completed Wave 3 Youth Interview and Wave 1 youth who were eligible for Wave 3 Youth Interview*

	Wave 1 youth who were eligible for Wave 3 Youth Interview		Wave 3 Youth Interview respondents who completed Wave 1 Youth Interview				
				Before Wave 3 weighting adjustment		After Wave 3 weighting adjustment	
Wave 1 characteristic[a]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Sample size	Weighted estimate, using Wave 1 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]	Weighted estimate, using Wave 3 final weights [95% confidence interval]	Difference in weighted estimates [Wave 3 – Wave 1] [95% confidence interval]
Overall	8,773	13.7% [12.8%, 14.6%]	7,470	13.2% [12.3%, 14.1%]	-0.5% [-0.8%, -0.2%]	13.4% [12.6%, 14.4%]	-0.2% [-0.6%, 0.1%]
Sex							
Male	4,482	14.5% [13.4%, 15.6%]	3,823	14.0% [12.9%, 15.2%]	-0.5% [-1.0%, 0.0%]	14.3% [13.2%, 15.5%]	-0.2% [-0.7%, 0.3%]
Female	4,264	12.8% [11.7%, 14.0%]	3,628	12.3% [11.2%, 13.5%]	-0.5% [-1.0%, -0.0%]	12.5% [11.4%, 13.8%]	-0.3% [-0.8%, 0.2%]
Age group[b]							
12-13	4,392	7.8% [6.9%, 8.8%]	3,734	7.7% [6.6%, 8.9%]	-0.2% [-0.6%, 0.3%]	7.5% [6.5%, 8.7%]	-0.3% [-0.7%, 0.2%]
14-17	4,381	19.5% [18.2%, 20.8%]	3,736	18.6% [17.4%, 20.0%]	-0.8% [-1.4%, -0.3%]	19.3% [18.0%, 20.5%]	-0.2% [-0.8%, 0.4%]
Race/ethnicity							
Hispanic	2,543	13.1% [11.8%, 14.5%]	2,199	12.6% [11.3%, 14.1%]	-0.5% [-1.2%, 0.1%]	12.9% [11.5%, 14.3%]	-0.3% [-0.9%, 0.4%]
Non-Hispanic White alone	4,080	14.5% [13.2%, 16.0%]	3,434	13.7% [12.4%, 15.2%]	-0.8% [-1.3%, -0.3%]	13.9% [12.6%, 15.3%]	-0.6% [-1.1%, -0.1%]
Non-Hispanic Black alone	1,151	11.7% [9.7%, 13.9%]	980	12.2% [9.8%, 15.0%]	0.5% [-0.5%, 1.4%]	12.5% [10.1%, 15.3%]	0.8% [-0.2%, 1.7%]
Non-Hispanic other race or multiple races	806	13.7% [11.5%, 16.3%]	690	13.6% [11.3%, 16.4%]	-0.1% [-1.1%, 0.9%]	14.0% [11.6%, 16.8%]	0.3% [-0.8%, 1.4%]

* An 'ever user' is someone who has ever used one or more of the tobacco products covered by the Wave 1 Youth Interview. A 'never user' is someone who has never used any of those tobacco products. Ever use of a tobacco product is defined as having ever used the product, even one or two times. The products covered by the Wave 1 Youth Interview are cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, e-cigarettes, dissolvable tobacco, bidis, and kretek.

[a] For each Wave 1 characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] Table 5-3 includes a subset of the youth in Table 5-2 because there are no Wave 1 interview data for the Wave 3 Youth Interview respondents who were shadow youth at Wave 1.

5.3 Comparison of Cigarette-Smoking Estimates between the PATH Study and Other National Studies

Table 5-4 compares estimates for two common measures of youth cigarette-smoking based on Wave 3 of the PATH Study to similar estimates based on data from NHANES 2016, NSDUH 2016, and NYTS 2016.[9] The caveats in the last paragraph of Section 4.3 also apply to the interpretation of the results in this section.

The primary measure of cigarette smoking among youth 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. Estimates of both measures are shown in Table 5-4, accompanied by 95 percent confidence intervals, for the youth population as a whole and for subgroups. The point estimates based on the PATH Study's Wave 3 Youth Interview were calculated using the Wave 3 final single-wave weights. The corresponding replicate weights were used to calculate variances and confidence intervals. Point estimates and 95 percent confidence intervals are reported for the other national studies as well. The PATH Study point estimates were generally lower than the estimates from the other studies. However, the confidence intervals overlapped between Wave 3 of the PATH Study, NHANES 2016, and NSDUH 2016 for most estimates.

As discussed in Section 4.3, some differences in the estimates may be attributable to the differences in question order and wording, mode of administration, and timeframes of the surveys. Based on this analysis alone, it is therefore unclear whether the PATH Study estimates of youth cigarette smoking are generally lower due to nonresponse bias in one or more of the estimates compared, or for other reasons. 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 that is self-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, but age 17 is the upper age limit for youth in the PATH Study. Finally, according to the Center for Behavioral Health Statistics and Quality (CBHSQ) (2015), cigarette smoking among teens dropped from 2013 to 2014 (the percentage of youth who had ever tried smoking dropped by 0.3 of a percentage point among 12- to 13-year-olds, 2.4 percentage points among 14- to 15-year-

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

olds, and 2.1 percentage points among 16- to 17-year-olds), and there were similar decreases from 2012 to 2013. The lower percentages found in the PATH Study may reflect, in part, a continuation of this trend.

Table 5-4. Comparison of youth cigarette-smoking estimates from PATH Study Wave 3 Youth Interview and other national studies*

Wave 3 outcome variable and subgroup	Subgroup sample size	PATH Study: Weighted estimate, using Wave 3 final weights [95% confidence interval]	Estimate from NHANES 2015-2016 [95% confidence interval]	Estimate from NSDUH 2016 [95% confidence interval]	Estimate from NYTS 2016 [95% confidence interval]
Ever tried cigarette smoking, even one or two puffs, overall	11,591	10.7% [10.0%, 11.4%]	12.9% [10.4%, 15.9%]	11.6% [10.8%, 12.5%]	18.9% [17.0%, 20.9%]
Ever tried smoking, male	5,979	10.7% [9.8%, 11.6%]	14.6% [10.1%, 20.6%]	12.3% [11.3%, 13.4%]	19.2% [17.4%,21.1%]
Ever tried smoking, female	5,583	10.7% [9.9%, 11.7%]	11.2% [8.6%, 14.4%]	10.9% [9.9%, 12.1%]	18.6% [16.4%,21.0%]
Ever tried smoking, age 12-13	4,032	3.6% [2.9%, 4.4%]	2.8% [1.1%, 6.7%]	3.1% [2.4%, 3.9%]	8.6% [7.1%, 10.4%]
Ever tried smoking, age 14-17	7,559	14.4% [13.5%, 15.3%]	17.5% [14.2%, 21.5%]	15.6% [14.5%, 16.7%]	24.0% [21.5%, 26.7%]
Have smoked in past 30 days, overall	11,797	3.2% [2.8%, 3.6%]	3.1% [1.9%, 5.0%]	3.5% [3.1%, 3.9%]	4.8% [4.1%, 5.6%]

* Estimates from all the external sources were obtained using public use files for those surveys. The modified Wilson confidence interval approach was used to compute the 95 percent confidence intervals for all the point estimates in the table.

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Wave 3 Adult Biospecimen Collection Nonresponse Bias Analysis Conditioning on Wave 3 Interview Response

6

6.1 Unweighted Response Rates

This section discusses unweighted response rates for the urine specimen collection and blood specimen collection among Wave 3 Adult Interview respondents who were asked to provide a biospecimen.[10] Each response rate was calculated as a ratio, with the numerator being the number of adults who provided a biospecimen and the denominator being the number of adults from whom a biospecimen was requested.

Tables 6-1 and 6-2 show the unweighted response rates for urine collection and blood collection, respectively. In addition to the overall rows, the response rates are tabulated by Wave 3 demographic characteristics, tobacco-use status, and for urine collection only, whether or not Wave 3 was the first time the respondent had completed a PATH Study Adult Interview. Adults with missing values for a particular characteristic were excluded from the response rate calculation for that characteristic.

As shown in Table 6-1, the unweighted response rate for urine collection was 96.0 percent overall, with little variation by sex and race/ethnicity. Current established tobacco users at Wave 3 were more likely to provide urine specimens (97.7 percent) than adults who were not current established users (94.1 percent). Adults ages 18-24 and first-time Adult Interview respondents were less likely to provide urine specimens,[11] however the response rates for both subgroups were above 85 percent.

[10] Weighted response rates are not provided because the subset of continuing adults asked to provide a urine specimen at Wave 3 does not represent a readily interpretable portion of the population. Similarly, while most first-time Adult Interview respondents were age 18 at Wave 3, some were older due to the actual time elapsed between the Wave 1 and Wave 3 interviews.

[11] These are highly correlated characteristics because all the first-time Adult Interview respondents were 18 to 24 years old.

Table 6-1. Wave 3 unweighted urine collection response rates among Wave 3 Adult Interview respondents selected to provide urine specimen

Wave 3 characteristic[a]	Number of persons selected to provide urine (n)	Number of persons who provided urine (n)	Unweighted response rate for urine collection (%)
Overall	15,607	14,979	96.0
Sex			
Male	7,928	7,594	95.8
Female	7,668	7,376	96.2
Age group			
18-24	5,746	5,352	93.1
25-44	5,345	5,229	97.8
45-64	3,565	3,487	97.8
65 and above	951	911	95.8
Race/ethnicity			
Hispanic	3,026	2,856	94.4
Non-Hispanic White alone	8,748	8,419	96.2
Non-Hispanic Black alone	2,415	2,340	96.9
Non-Hispanic other race or multiple races	1,197	1,152	96.2
Tobacco-use status[b]			
Current established user	8,054	7,866	97.7
Not current established user	7,399	6,966	94.1
First time completing Adult Interview			
Yes	1,907	1,641	86.1
No	13,700	13,338	97.4

[a] All the characteristics apply to the Wave 3 Adult Interview; however, respondents are asked to self-report their sex and race/ethnicity only once, during their first Youth or Adult Interview. For each characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] A tobacco user is defined as someone who uses one or more of the following tobacco products covered by the Wave 3 Adult Interview: cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, and electronic nicotine delivery systems or ENDS (including e-cigarettes, e-cigars, e-pipes, and e-hookah). A 'current established user' of a given tobacco product is someone who currently uses the product every day or some days and: for cigarettes, has smoked at least 100 cigarettes in their lifetime and, for any other tobacco product, has reported they ever used that product regularly.

As shown in Table 6-2, the unweighted response rate for blood collection among first-time Adult Interview respondents was 43.8 percent. Females and Hispanic persons were more likely to provide blood specimens than males and non-Hispanic persons. Blood collection response rates varied little by tobacco-use status. The overall response rate for blood collection was low (43.8%). However, response rates varied only moderately (i.e., by no more than 5.7 percent) across subgroups, indicating minimal potential for nonresponse bias.

Table 6-2. Wave 3 unweighted blood collection response rates among first-time Adult Interview respondents at Wave 3

Wave 3 characteristic[a]	Number of first-time Adult Interview respondents at Wave 3 (n)	Number of blood providers among first-time Adult Interview respondents at Wave 3 (n)	Unweighted response rate for blood collection (%)
Overall	1,907	835	43.8
Sex			
Male	957	407	42.5
Female	947	427	45.1
Race/ethnicity			
Hispanic	545	259	47.5
Non-Hispanic White alone	904	382	42.3
Non-Hispanic Black alone	274	115	42.0
Non-Hispanic other race or multiple races	165	69	41.8
Tobacco-use status[b]			
Current established user	296	131	44.3
Not current established user	1,569	687	43.8

[a] All the characteristics apply to the Wave 3 Adult Interview; however, respondents are asked to self-report their sex and race/ethnicity only once, during their first Youth or Adult Interview. For each characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] A tobacco user is defined as someone who uses one or more of the following tobacco products covered by the Wave 3 Adult Interview: cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, and electronic nicotine delivery systems or ENDS (including e-cigarettes, e-cigars, e-pipes, and e-hookah). A 'current established user' of a given tobacco product is someone who currently uses the product every day or some days and: for cigarettes, has smoked at least 100 cigarettes in their lifetime and, for any other tobacco product, has reported they ever used that product regularly.

6.2 Comparison between First-Time Adult Interview Respondents Who Provided a Biospecimen at Wave 3 and All First-Time Adult Interview Respondents

All first-time Adult Interview respondents in Wave 3 were asked to provide a urine specimen and a blood specimen. Table 6-3 compares the characteristics of Wave 3 first-time Adult Interview respondents who provided a urine specimen with all the Wave 3 first-time Adult Interview respondents. Table 6-4 presents a similar analysis for the collection of blood specimens. The Wave 3 final single-wave weights (which account for Wave 3 interview nonresponse) were used for generating all the estimates. Despite the nominal differences for some estimates (e.g., percentage of Hispanic persons for blood collection), the 95 percent confidence intervals for differences in Tables

6-3 and 6-4 all included zero. In other words, there were no statistically significant differences at the 0.05 level of significance between estimates based on Wave 3 first-time Adult Interview respondents who provided a specimen and estimates based on all Wave 3 first-time Adult Interview respondents.

Note that this analysis applies to first-time Adult Interview respondents only, not to all Wave 3 Adult Interview respondents. Most of the first-time Adult Interview respondents at Wave 3 were 18 years old, but a small proportion may have been older. Also, not all Wave 3 biospecimens collected from first-time Adult Interview respondents will be selected for laboratory analysis, so the results in Tables 6-3 and 6-4 may not correspond to those who will have Wave 3 biomarker data.

Table 6-3. Comparison of Wave 3 characteristics between first-time Adult Interview respondents who provided a urine specimen at Wave 3 and all first-time Adult Interview respondents

Wave 3 characteristic[a]	All first-time Adult Interview respondents at Wave 3		Urine providers among first-time Adult Interview respondents at Wave 3		Difference in weighted percentages [urine providers – all first-time Adult Interview respondents at Wave 3] [95% confidence interval]
	Unweighted count	Weighted percentage, using Wave 3 final weights [95% confidence interval]	Unweighted count	Weighted percentage, using Wave 3 final weights [95% confidence interval]	
Sex					
Male	957	51.3% [49.1%, 53.6%]	829	51.4% [49.0%, 53.9%]	0.1% [-1.0%, 1.2%]
Female	947	48.7% [46.4%, 50.9%]	810	48.6% [46.1%, 51.0%]	-0.1% [-1.2%, 1.0%]
Race/ethnicity					
Hispanic	545	22.0% [20.2%, 23.9%]	470	22.2% [20.2%, 24.3%]	0.2% [-0.5%, 0.9%]
Non-Hispanic White alone	904	54.5% [52.3%, 56.7%]	773	54.4% [52.0%, 56.8%]	-0.1% [-1.2%, 1.0%]
Non-Hispanic Black alone	274	14.2% [12.7%, 15.8%]	241	14.5% [12.9%, 16.3%]	0.3% [-0.4%, 1.0%]
Non-Hispanic other race or multiple races	165	9.4% [8.1%, 10.7%]	140	8.9% [7.6%, 10.4%]	-0.4% [-1.2%, 0.3%]
Tobacco-use status[b]					
Current established user	296	16.3% [14.5%, 18.3%]	252	16.3% [14.3%, 18.6%]	0.0% [-0.9%, 0.9%]
Not current established user	1,569	83.7% [81.7%, 85.5%]	1,347	83.7% [81.4%, 85.7%]	0.0% [-0.9%, 0.9%]

[a] All the characteristics apply to the Wave 3 Adult Interview; however, respondents are asked to self-report their sex and race/ethnicity only once, during their first Youth or Adult Interview. For each characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] A tobacco user is defined as someone who uses one or more of the following tobacco products covered by the Wave 3 Adult Interview: cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, and electronic nicotine delivery systems or ENDS (including e-cigarettes, e-cigars, e-pipes, and e-hookah). A 'current established user' of a given tobacco product is someone who currently uses the product every day or some days and: for cigarettes, has smoked at least 100 cigarettes in their lifetime and, for any other tobacco product, has reported they ever used that product regularly.

Table 6-4. Comparison of Wave 3 characteristics between first-time Adult Interview respondents who provided a blood specimen at Wave 3 and all first-time Adult Interview respondents

Wave 3 characteristic[a]	All first-time Adult Interview respondents at Wave 3		Blood providers among first-time Adult Interview respondents at Wave 3		Difference in weighted percentages [blood providers – all first-time Adult Interview respondents at Wave 3] [95% confidence interval]
	Unweighted count	Weighted percentage, using Wave 3 final weights [95% confidence interval]	Unweighted count	Weighted percentage, using Wave 3 final weights [95% confidence interval]	
Sex					
Male	957	51.3% [49.1%, 53.6%]	407	49.8% [46.4%, 53.2%]	-1.6% [-4.6%, 1.4%]
Female	947	48.7% [46.4%, 50.9%]	427	50.2% [46.8%, 53.6%]	1.6% [-1.4%, 4.6%]
Race/ethnicity					
Hispanic	545	22.0% [20.2%, 23.9%]	259	24.3% [21.5%, 27.3%]	2.3% [-0.2%, 4.8%]
Non-Hispanic White alone	904	54.5% [52.3%, 56.7%]	382	53.6% [50.2%, 57.0%]	-0.9% [-3.8%, 2.0%]
Non-Hispanic Black alone	274	14.2% [12.7%, 15.8%]	115	13.9% [11.7%, 16.4%]	-0.3% [-2.2%, 1.6%]
Non-Hispanic other race or multiple races	165	9.4% [8.1%, 10.7%]	69	8.2% [6.5%, 10.3%]	-1.1% [-2.9%, 0.6%]
Tobacco-use status[b]					
Current established user	296	16.3% [14.5%, 18.3%]	131	16.9% [14.5%, 19.7%]	0.6% [-1.4%, 2.7%]
Not current established user	1,569	83.7% [81.7%, 85.5%]	687	83.1% [80.3%, 85.5%]	-0.6% [-2.7%, 1.4%]

[a] All the characteristics apply to the Wave 3 Adult Interview; however, respondents are asked to self-report their sex and race/ethnicity only once, during their first Youth or Adult Interview. For each characteristic, the sum of the counts in all the categories may not be equal to the count in the overall row due to missing values.

[b] A tobacco user is defined as someone who uses one or more of the following tobacco products covered by the Wave 3 Adult Interview: cigarettes, traditional cigars, cigarillos, filtered cigars, pipes, smokeless tobacco, snus, hookah, and electronic nicotine delivery systems or ENDS (including e-cigarettes, e-cigars, e-pipes, and e-hookah). A 'current established user' of a given tobacco product is someone who currently uses the product every day or some days and: for cigarettes, has smoked at least 100 cigarettes in their lifetime and, for any other tobacco product, has reported they ever used that product regularly.

7 Summary of Findings

This section summarizes the PATH Study's Wave 3 Adult and Youth Interview response rates among Wave 1 participants. It briefly discusses the national representativeness of Wave 3 respondents and statistical weighting adjustments to reduce potential nonresponse bias. In addition, this section includes results on nonresponse to the Wave 3 biospecimen collections among Wave 3 Adult Interview respondents.

The unweighted and weighted response rates for the Wave 3 Adult Interview were similar overall and by subgroup, although there were differences across subgroups:

- The weighted response rate was lower among males than among females; this pattern is consistent with most household surveys.
- Persons of non-Hispanic other or multiple races had a moderately lower weighted response rate than the other race/ethnicity groups; this may be partly because interviews were offered in only English and Spanish.

However, differences in response rates do not necessarily indicate nonresponse bias in the Wave 3 Adult Interview estimates.

In comparing the demographic and socio-economic characteristics between the Wave 3 Adult Interview respondents and those eligible for the Wave 3 Adult Interview, the notable underrepresentation among the Wave 3 adult respondents was for the male population, which tends to exhibit lower response propensity than the female population in most household surveys.

After Wave 3 weighting adjustments, the differences between the respondents and those eligible for the Adult Interview were negligible with the exception of the Wave 1 "ever tobacco use" measure for non-Hispanic Black alone adults who were youth at Wave 1. These results reflect the use of both demographic variables and tobacco-use measures from Wave 1 to calibrate the Wave 3 interview weights.

Estimates of adult current cigarette-smoking rates from Wave 3 of the PATH Study were similar to estimates from NHANES 2015-2016. Estimates from TUS-CPS 2014-2015 and NHIS 2016 tended to be lower than those from Wave 3 of the PATH Study and NHANES 2015-2016, while estimates from NSDUH 2016 tended to be higher than those from Wave 3 of the PATH Study and

NHANES 2015-2016. However, there is no evidence of nonresponse bias in the PATH Study with respect to current cigarette-smoking behavior among adults, in the sense that the PATH Study's estimates were all within the range of estimates from other national studies.

Some Wave 3 Adult Interview respondents were asked to provide biospecimens. The overall response rate for urine collection was 96.0 percent, with the lowest rate by subgroup being over 86 percent. The response rate for blood collection was 43.8 percent. Females and Hispanic persons were more likely to provide blood specimens than males and non-Hispanic persons, but blood collection response rates varied little by tobacco-use status. However, based on the results presented in Tables 6-3 and 6-4, there were no indications of potential nonresponse bias in the Wave 3 biospecimen data collections.

The unweighted and weighted response rates for the Wave 3 Youth Interview were also similar overall and by subgroup. Differences by subgroup included the following:

- Moderate differences (i.e., by no more than 2.3 percent) by Wave 1 sex and race/ethnicity.
- The weighted response rate for the "under 12" age group was noticeably lower than for the "12-13" and "14-17" age groups, where the age groups are defined as of Wave 1. This is likely because the persons in the "under 12" age group were shadow youth at Wave 1, so for some of them the Wave 3 Youth Interview was the first PATH Study interview they were asked to complete. (The Wave 2 weighted response rate was also lower among youth who were shadow youth at Wave 1 (82.1 percent) than among those who had completed a Youth Interview at Wave 1 (88.4 percent).)
- The weighted response rate among Wave 1 youth was lower for the Wave 1 "ever tobacco user" group than for the Wave 1 "never user" group.

These differences in response rates do not necessarily indicate nonresponse bias in the Wave 3 Youth Interview estimates as variation in response rates by subgroups is to be expected in large-scale data collection efforts.

The sex and race/ethnicity distributions among Wave 3 Youth Interview respondents were almost the same as the distributions among those eligible for the Wave 3 Youth Interview, both before and after the Wave 3 weighting adjustments. Because Wave 1 demographic and tobacco-use variables were incorporated in the control totals for calibration during the Wave 3 nonresponse adjustment process, the estimates after the Wave 3 weighting adjustments for the Wave 1"under 12" age and "ever user" groups were almost identical between Wave 3 respondents and those eligible for the Wave 3 interviews.

The PATH Study estimates of youth cigarette-smoking rates were generally lower than the estimates from the other studies. However, the confidence intervals overlapped between Wave 3 of the PATH Study, NHANES 2016, and NSDUH 2016 for most estimates.

Assuming that the Wave 1 demographic, socio-economic, and tobacco-use characteristics studied are correlated with key tobacco and health related outcome measures in Wave 3 of the PATH Study, these results indicate little if any nonresponse bias in the Adult and Youth Interview estimates due to attrition from Wave 1 to Wave 3.

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Appendix A
Cigarette-Smoking Questions in 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 a respondent has smoked at least 100 cigarettes in his or her lifetime has closed response categories:

"How many cigarettes have you smoked in your entire life? A pack usually has 20 cigarettes in it."

For adults:

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).

For youth:

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

6. 51 to 99 (more than 2 ½ packs but less than 5 packs); and

7. 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. Questions used to define adult current cigarette 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?" (Wave 1 adult question, yes) and "Have you ever tried cigarette smoking, even one or two puffs?" (Wave 1 youth question, yes) and "In the past 30 days, have you smoked a cigarette, even one or two puffs?" (Wave 2, Wave 3 adult question, yes) and "In the past 12 months, have you smoked a cigarette, even one or two puffs" (Wave 2, Wave 3 adult and Wave 2 youth question, 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." (Wave 1, Wave 2, Wave 3 adult and	"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)	"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)	"{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)	"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?" and "How long has it been since you last smoked part or all of a cigarette?" (within the past 30 days)	"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?" and "How long has it been since you last smoked part or all of a cigarette?" (within the past 30 days) and "Have you smoked at least 100 cigarettes in your entire life?" (yes)

PATH Study	TUS-CPS*	NHIS	NHANES	NSDUH (original definition)	NSDUH (modified definition)**
Wave 1, Wave 2 youth question, 100 or more cigarettes (5 packs or more))					
Age range included in estimates					
18+	18+	18+	18+	18+	18+

Table A-1. Questions used to define adult current cigarette smoking in the PATH Study, TUS-CPS, NHIS, NHANES, and NSDUH (continued)

PATH Study	TUS-CPS*	NHIS	NHANES	NSDUH (original definition)	NSDUH (modified definition)**
Exclusions from population					
The Wave 1 target population included only the U.S. civilian, noninstitutionalized population. The target population for Wave 3 was the Wave 1 target population residing in the U.S. at Wave 3, except for those who were incarcerated at that time. Thus, it includes Wave 1 respondents who were on active duty or living in a health care institution (e.g., a nursing home) but not those in a correctional facility at Wave 3.	Includes only the U.S. civilian, non-institutionalized population.	Includes only the civilian noninstitutionalized population residing in the U.S. at the time of the interview. Several segments of the population are excluded, such as: persons in long-term care institutions; persons on active duty with the Armed Forces; persons in correctional facilities; and U.S. nationals living in foreign countries.	Includes only the U.S. civilian, non-institutionalized population.	Includes only the U.S. civilian, non-institutionalized population. Excludes homeless persons who do not use shelters, military personnel on active duty, and residents of institutional group quarters, such as jails and hospitals.	Includes only the U.S. civilian, non-institutionalized population. Excludes homeless persons who do not use shelters, military personnel on active duty, and residents of institutional group quarters, such as jails and hospitals.
Proxy responses allowed					
No	Yes	Yes, for individuals physically or mentally incapable of responding.	Yes, when there is a serious physical or mental condition, a proxy respondent may be used to conduct the interview.	No	No

*Proxies are allowed if fourth callback or the person will not return before closeout. See https://cancercontrol.cancer.gov/brp/tcrb/tus-cps/surveys/A1_TUS-CPS-Questionnaire.pdf, p2.

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

Table A-2. Questions used to define 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?" (Wave 1 youth, Wave 2 and Wave 3 new baseline youth question, yes) and "In the past 12 months, have you smoked a cigarette, even one or two puffs?" (Wave 2, Wave 3 question for continuing youth, yes)	"About how many cigarettes have you smoked in your entire life?" (1 or more puffs to 100 or more cigarettes)	Have you ever smoked part or all of a cigarette?" (yes)	"Have you ever tried cigarette smoking, even one or two puffs?" (yes)
Questions for determining whether have smoked in past 30 days			
["Have you ever tried cigarette smoking, even one or two puffs?" (Wave 1 youth, Wave 2 and Wave 3 new baseline youth question, yes) and "In the past 12 months, have you smoked a cigarette, even one or two puffs?" (Wave 2, Wave 3 question for continuing youth, 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)	"On how many of the past 30 days did {you/SP} smoke a cigarette?" (1-30)	"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 "During the past 30 days, that is since [DATEFILL], on how many days did you smoke part or all of a cigarette?" (1-30) and "What is your best estimate of the number of days you smoked part or all of a cigarette during the past 30 days?" (1 or 2 days to all 30 days)]	"During the past 30 days, on how many days did you smoke cigarettes?" (1-30)
Age range included in estimates			
12-17	12-17	12-17	12-17

Table A-2. Questions used to define youth cigarette smoking in the PATH Study, NHANES, NSDUH, and NYTS (continued)

PATH Study	NHANES	NSDUH	NYTS
Exclusions from population			
The Wave 1 target population included only the U.S. civilian, noninstitutionalized population. The target population for Wave 3 was the Wave 1 target population residing in the U.S. at Wave 3, except for those who were incarcerated at that time. Thus, it includes Wave 1 respondents who were on active duty or living in a health care institution (e.g., a nursing home) but not those in a correctional facility at Wave 3.	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, such as jails and hospitals.	Only includes youth who are public and private school students enrolled in regular middle schools and high schools in grades 6 through 12 in the 50 U.S. States and the District of Columbia. Alternative schools, special education schools, Department of Defense operated schools, Bureau of Indian Affairs schools, vocational schools that serve only pull-out populations, and students enrolled in regular schools unable to complete the questionnaire without special assistance, are excluded.

Table A-2. Questions used to define youth cigarette smoking in the PATH Study, NHANES, NSDUH, and NYTS (continued)

PATH Study	NHANES	NSDUH	NYTS
Other comments			
	Youth with missing values for the response to the question about number of lifetime cigarettes smoked were excluded from the estimates of ever tried cigarette smoking. Youth with missing values for the response to the question about number of cigarettes smoked in the past 30 days were excluded from the estimates of past 30 day cigarette use unless the value was missing because the youth had never smoked a cigarette in his/her lifetime. Youth who had never smoked were treated as having smoked zero cigarettes in the past 30 days.		Self-administered survey in classroom.

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