California Health Interview Survey (CHIS)

July 30, 2014

CHIS 2011-2012 Methodology Report Series

Report 5

Weighting and Variance Estimation

CALIFORNIA HEALTH INTERVIEW SURVEY

<u>CHIS 2011-2012 METHODOLOGY SERIES</u>

REPORT 5

WEIGHTING AND VARIANCE ESTIMATION

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This report describes the weighting and variance estimation methods used in CHIS 2011-2012. This report presents the steps used to create the analytical weights for analyzing the data from the adult, child, and adolescent interviews.

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PREFACE

Weighting and Variance Estimation is the fifth in a series of methodological reports describing the 2011-2013 California Health Interview Survey. The other reports are listed below.

CHIS is a collaborative project of the University of California, Los Angeles (UCLA) Center for Health Policy Research, the California Department of Public Health, the Department of Health Care Services, and the Public Health Institute. Westat was responsible for data collection and the preparation of five methodological reports from the 2011-2013 survey. The survey examines public health and health care access issues in California. The telephone survey is the largest state health survey ever undertaken in the United States. The plan is to monitor these issues and examine changes over time by conducting surveys in the future.

Methodological Reports for CHIS 2011-12

The first five methodological reports for CHIS 2011-2012 are as follows:

- Report 1: Sample Design;
- Report 2: Data Collection Methods;
- Report 3: Data Processing Procedures;
- Report 4: Response Rates; and
- Report 5: Weighting and Variance Estimation.

The reports are interrelated and contain many references to each other. For ease of presentation, the references are simply labeled by the report numbers given above. After the Preface, each report includes an “Overview” chapter (Chapter 1) that is nearly identical across reports, followed by detailed technical documentation on the specific topic of the report.

Report 5: Weighting and Variance Estimation (this report) describes the weighting and variance estimation methods from CHIS 2011-2012. The purpose of weighting the survey data is to permit analysts to produce estimates of the health characteristics for the entire California population and subgroups including counties, and in some cases, cities. This report presents the steps used to create the analytical weights for analyzing the data from the adult, child, and adolescent interviews.

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1. CHIS 2011-2012 SAMPLE DESIGN AND METHODOLOGY SUMMARY

1.1 Overview

The California Health Interview Survey (CHIS) is a population-based telephone survey of California conducted every other year since 2001 and continually beginning in 2011. CHIS is the largest state health survey conducted and one of the largest health surveys in the nation. CHIS is conducted by the UCLA Center for Health Policy Research (UCLA-CHPR) in collaboration with the California Department of Public Health, the Department of Health Care Services, First 5 California, The California Endowment, the National Cancer Institute, and Kaiser Permanente. CHIS collects extensive information for all age groups on health status, health conditions, health-related behaviors, health insurance coverage, access to health care services, and other health and health related issues.

The sample is designed to meet and optimize two objectives:

1) Provide estimates for large- and medium-sized counties in the state, and for groups of the smallest counties (based on population size), and

2) Provide statewide estimates for California's overall population, its major racial and ethnic groups, as well as several Asian and Latino ethnic subgroups.

The CHIS sample is representative of California's non-institutionalized population living in households. CHIS data and results are used extensively by federal and State agencies, local public health agencies and organizations, advocacy and community organizations, other local agencies, hospitals, community clinics, health plans, foundations, and researchers. These data are used for analyses and publications to assess public health and health care needs, to develop and advocate policies to meet those needs, and to plan and budget health care coverage and services. Many researchers throughout California and the nation use CHIS data files to further their understanding of a wide range of health-related issues (visit the CHIS Research Clearinghouse: http://healthpolicy.ucla.edu/chis/research/Pages/default.aspx for many examples of these studies).

This series of reports describes the methods used in collecting data for CHIS 2011-2012, the sixth CHIS data collection cycle, which was conducted between June 2011 and January 2013. The previous CHIS cycles (2001, 2003, 2005, 2007, and 2009) are described in similar series, available at http://healthpolicy.ucla.edu/chis/design/Pages/methodology.aspx.

1.2 Switch to a Continuous Survey

From the first CHIS cycle in 2001 through 2009, CHIS data collection was biennial, with data collected during a 7-9 month period every other year. Beginning in 2011, CHIS data are collected continually over each 2-year cycle. This change was driven by several factors including the ability to track and release information about health in California on a more frequent and timely basis and to eliminate potential seasonality in the biennial data.

The CHIS 2011-2012 data included in these files were collected between June 2011 and January 2013. Approximately half of the interviews were conducted during the 2011 calendar year and half during the 2012 calendar year. As in previous CHIS cycles, weights are included with the data files and are based on the State of California's Department of Finance population estimates and projections, adjusted to remove the population living in group quarters (such as nursing homes, prisons, etc. and not eligible to participate in CHIS). When the weights are applied to the data, the results represent California's residential population during that one year period for the age group corresponding to the data file in use (adult, adolescent, or child).

See what else is new in the 2011-2012 CHIS sampling and data collection here: http://healthpolicy.ucla.edu/chis/design/Documents/whats-new-chis-2011-2012.pdf

In order to provide CHIS data users with more complete and up-to-date information to facilitate analyses of CHIS data, additional information on how to use the CHIS sampling weights, including sample code, is available at: http://healthpolicy.ucla.edu/chis/analyze/Pages/sample-code.aspx

Additional documentation on constructing the CHIS sampling weights is available in CHIS 2011-2012 Methods Report #5—Weighting and Variance Estimation, available at: http://healthpolicy.ucla.edu/chis/design/Pages/methodology.aspx. Other helpful information for understanding the CHIS sample design and data collection processing can be found in the four other methodology reports for each CHIS cycle year, described in the Preface above.

1.3 Sample Design Objectives

The CHIS 2011-2012 sample was designed to meet two sampling objectives discussed above: (1) provide estimates for adults in most counties and groups of counties with small populations; and (2) provide estimates for California's overall population, major racial and ethnic groups, and for several smaller ethnic subgroups.

To achieve these objectives, CHIS employed a dual-frame, multi-stage sample design. The random-digit-dial (RDD) sample included telephone numbers assigned to both landline and cellular service. The random-digit-dial (RDD) sample was approximately 80% landline and 20% cellular phone numbers. For the landline RDD sample, the 58 counties in the state were grouped into 44 geographic sampling strata, and 14 sub-strata were created within two of the largest metropolitan areas in the state (Los Angeles and San Diego). The Los Angeles County stratum included 8 sub-strata for Service Planning Areas, and the San Diego County stratum included 6 sub-strata for Health Service Regions. Most of the strata (39 of 44) are made up of a single county with no sub-strata (counties 3-41 in Table 1-1), with three multi-county strata comprised of the 17 remaining counties (see Table 1-1). A sufficient number of adult interviews were allocated to each stratum and sub-stratum to support the first sample design objective—to provide health estimates for adults at the local level. The same geographic stratification of the state has been used since CHIS 2005. In the first two CHIS cycles (2001 and 2003) there were 47 total sampling strata, including 33 individual counties and one county with sub-strata (Los Angeles).

Within each geographic stratum, residential telephone numbers were selected, and within each household, one adult (age 18 and over) respondent was randomly selected. In those households with adolescents (ages 12-17) and/or children (under age 12), one adolescent and one child were randomly selected; the adolescent was interviewed directly, and the adult most knowledgeable about the child's health completed the child interview.

The RDD CHIS sample is of sufficient size to accomplish the second objective (produce estimates for the state's major racial/ethnic groups, as well as many ethnic subgroups). To increase the precision of estimates for Koreans and Vietnamese, areas with relatively high concentrations of these groups were sampled at higher rates. These geographically targeted oversamples were supplemented by telephone numbers associated with group-specific surnames drawn from listed telephone directories to further increase the sample size for Koreans and Vietnamese.

Table 1-1. California county and county group strata used in the CHIS 2011-2012 sample design

1. Los Angeles	7. Alameda	27. Shasta
1.1 Antelope Valley	8. Sacramento	28. Yolo
1.2 San Fernando Valley	9. Contra Costa	29. El Dorado
1.3 San Gabriel Valley	10. Fresno	30. Imperial
1.4 Metro	11. San Francisco	31. Napa
1.5 West	12. Ventura	32. Kings
1.6 South	13. San Mateo	33. Madera
1.7 East	14. Kern	34. Monterey
1.8 South Bay	15. San Joaquin	35. Humboldt
2. San Diego	16. Sonoma	36. Nevada
2.1 N. Coastal	17. Stanislaus	37. Mendocino
2.2 N. Central	18. Santa Barbara	38. Sutter
2.3 Central	19. Solano	39. Yuba
2.4 South	20. Tulare	40. Lake
2.5 East	21. Santa Cruz	41. San Benito
2.6 N. Inland	22. Marin	42. Colusa, Glen, Tehama
3. Orange	23. San Luis Obispo	43. Plumas, Sierra, Siskiyou,
4. Santa Clara	24. Placer	Lassen, Modoc, Trinity, Del Norte
5. San Bernardino	25. Merced	44. Mariposa, Mono, Tuolumne,
6. Riverside	26. Butte	Alpine, Amador, Calaveras, Inyo

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

To help compensate for the increasing number of households without landline telephone service, a separate RDD sample was drawn of telephone numbers assigned to cellular service. In CHIS 2011-2012, the goal was to complete approximately 8,000 interviews (20% of all RDD interviews statewide) with adults from the cell phone sample. Telephone numbers assigned to cellular service cannot be geographically stratified at the county level with sufficient precision, so the cell RDD sample was geographically stratified into 28 strata using 7 CHIS regions and telephone area codes. If a sampled cell number was shared by two or more adult members of a household, one household member was selected for the adult interview. Otherwise, the adult owner of the sampled number was selected. Cell numbers used exclusively by children under 18 were considered ineligible. About 550 teen interviews and 1,500 child interviews were completed from the cell phone sample in CHIS 2011-2012.

The CHIS 2011-2012 and 2009 cell phone sampling method differed from that used in CHIS 2007 in two significant ways. First, in CHIS 2011-2012, all cell phone sample numbers used for non-business purposes by adults living in California were eligible for the extended interview, while in 2007 only cell numbers belonging to adults in cell-only households were eligible. Thus, adults in households with landlines who had their own cell phones or shared one with another adult household member could have been selected through either the cell or landline sample. The second change to the cell phone sample was the inclusion of child and adolescent extended interviews.

Unlike both CHIS 2007 and CHIS 2009, where the cell phone sample quotas were treated separately from the landline sample, the CHIS 2011-2012 cell sample respondents were included in the overall and county specific target sample sizes. Twenty-eight cell phone sampling strata were created using CHIS 2007 and 2009 cell phone respondents' data and their pre-assigned FIPS county code, supplied by the sampling vendor. The statewide target of 8,000 adult cell phone interviews was also supplemented with an oversample to yield approximately 1,150 adult cell phone interviews. The oversample focused on six counties; Los Angeles, Orange, Santa Clara, Alameda, San Francisco, and San Mateo.

Finally, the CHIS 2011-2012 sample included an American Indian/Alaska Native (AIAN) oversample. This oversample was sponsored by Urban American Indian Involvement, Inc., and California Indian Health Services. The purpose of this oversample was to increase the number of AIAN participants and improve the statistical stability and precision of estimates for this group. The oversample was conducted using a list provided by Indian Health Services.

1.4 Data Collection

To capture the rich diversity of the California population, interviews were conducted in five languages: English, Spanish, Chinese (Mandarin and Cantonese dialects), Vietnamese, and Korean. These languages were chosen based on analysis of 2000 Census data to identify the languages that would cover the largest number of Californians in the CHIS sample that either did not speak English or did not speak English well enough to otherwise participate.

Westat, a private firm that specializes in statistical research and large-scale sample surveys, conducted CHIS 2011-2012 data collection under contract with the UCLA Center for Health Policy Research. For all samples, Westat staff interviewed one randomly selected adult in each sampled household, and sampled one adolescent and one child if they were present in the household and the sampled adult was the parent or legal guardian. Thus, up to three interviews could have been completed in each household. In landline sample households with children where the sampled adult was not the screener respondent, children and adolescents could be sampled as part of the screening interview, and the extended child (and adolescent) interviews could be completed before the adult interview. This "child-first" procedure was new for CHIS 2005 and has been continued in subsequent CHIS cycles; this procedure substantially increases the yield of child interviews. While numerous subsequent attempts were made to complete the adult interview child-first cases, there are completed child and/or adolescent interviews in households for which an adult interview was not completed. Table 1-2 shows the number of completed adult, child, and adolescent interviews in CHIS 2011-2012 by the type of sample (landline RDD, surname list, cell RDD, and American Indian/Alaska Native list).

Table 1-2. Number of completed CHIS 2011-2012 interviews by type of sample and instrument

Type of sample	Adult	Child	Adolescent
Total all samples	42,935[1]	7,334	2,799
Landline RDD	32,692	5,600	2,164
Surname list	825	161	57
Cell RDD	9,151	1,523	557
American Indian/Alaska Native list	267	50	21

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Interviews in all languages were administered using Westat's computer-assisted telephone interviewing (CATI) system. The average adult interview took about 35 minutes to complete. The average child and adolescent interviews took about 15 minutes and 23 minutes, respectively. For "child-first" interviews, additional household information asked as part of the child interview averaged about 9 minutes. Interviews in non-English languages generally took longer to complete. More than 14 percent of the adult interviews were completed in a language other than English, as were about 27 percent of all child (parent proxy) interviews and 7 percent of all adolescent interviews.

Table 1-3 shows the major topic areas for each of the three survey instruments (adult, child, and adolescent).

1.5 Response Rates

The overall response rate for CHIS 2011-2012 is a composite of the screener completion rate (i.e., success in introducing the survey to a household and randomly selecting an adult to be interviewed) and the extended interview completion rate (i.e., success in getting one or more selected persons to complete the extended interview). To maximize the response rate, especially at the screener stage, an advance letter in five languages was mailed to all landline sampled telephone numbers for which an address could be

[1] Numbers in this table represent the data publically released and available through our Data Access Center. Total sample sizes may differ for specific calculations within the five methodology reports, or for specific analyses based on CHIS data.

obtained from reverse directory services. An advance letter was mailed for 48.3 percent of the landline RDD sample telephone numbers not identified by the sample vendor as business or nonworking numbers,

Table 1-3. CHIS 2011-2012 survey topic areas by instrument

Health status	**Adult**	**Teen**	**Child**
General health status	✓	✓	✓
Days missed from school due to health problems	✓	✓	✓
Health-related quality of life (HRQOL)		✓	
Health conditions	**Adult**	**Teen**	**Child**
Asthma	✓	✓	✓
Diabetes, gestational diabetes, pre- /borderline diabetes	✓		
Heart disease, high blood pressure, stroke	✓		
Arthritis, physical disability	✓		
Epilepsy		✓	
Physical, behavioral, and/or mental conditions			✓
Mental health	**Adult**	**Teen**	**Child**
Mental health status	✓	✓	
Perceived need, access and utilization of mental health services	✓	✓	
Functional impairment, stigma	✓		
Suicide ideation and attempts	✓		
Health behaviors	**Adult**	**Teen**	**Child**
Dietary intake, fast food	✓	✓	✓
Physical activity and exercise, commute from school to home		✓	✓
Walking for transportation and leisure	✓		
Doctor discussed nutrition/physical activity		✓	✓
Flu Shot	✓		✓
Alcohol and cigarette use	✓	✓	
Illegal drug use		✓	
Sexual behavior	✓	✓	
HIV/STI testing		✓	
Elderly falls	✓		
Women's health	**Adult**	**Teen**	**Child**
Mammography screening	✓		
Pregnancy	✓	✓	

Table 1-3. CHIS 2011-2012 survey topic areas by instrument (continued)

Dental health	**Adult**	**Teen**	**Child**
Last dental visit, main reason haven't visited dentist		✓	✓
Neighborhood and housing	Adult	**Teen**	**Child**
Safety, social cohesion	✓	✓	✓
Homeownership, length of time at current residence	✓		
Park use		✓	✓
Civic engagement	✓	✓	
Access to and use of health care	**Adult**	**Teen**	**Child**
Usual source of care, visits to medical doctor	✓	✓	✓
Emergency room visits	✓	✓	✓
Delays in getting care (prescriptions and medical care)	✓	✓	✓
Medical home, timely appointments, hospitalizations	✓	✓	✓
Communication problems with doctor	✓		✓
Internet use for health information	✓		✓
Food environment	**Adult**	**Teen**	**Child**
Access to fresh and affordable foods	✓		
Where teen/child eats breakfast/lunch, fast food at school		✓	✓
Availability of food in household over past 12 months	✓		
Health insurance	**Adult**	**Teen**	**Child**
Current insurance coverage, spouse's coverage, who pays for coverage	✓	✓	✓
Health plan enrollment, characteristics and plan assessment	✓	✓	✓
Whether employer offers coverage, respondent/spouse eligibility	✓		
Coverage over past 12 months, reasons for lack of insurance	✓	✓	✓
Difficulty finding private health insurance	✓		
High deductible health plans	✓	✓	✓
Partial scope Medi-Cal	✓		
Public program eligibility	**Adult**	**Teen**	**Child**
Household poverty level	✓		
Program participation (CalWORKs, Food Stamps, SSI, SSDI, WIC, TANF)	✓	✓	✓
Assets, alimony/child support, social security/pension	✓		
Medi-Cal and Healthy Families eligibility	✓	✓	✓
Reason for Medi-Cal non-participation among potential beneficiaries	✓	✓	✓
Bullying and interpersonal violence	**Adult**	**Teen**	**Child**
Bullying, personal safety, interpersonal violence		✓	
Parental involvement/adult supervision	**Adult**	**Teen**	**Child**
Adult presence after school, role models, resiliency		✓	
Parental involvement			✓

Table 1-3. CHIS 2011-2012 survey topic areas by instrument (continued)

Child care and school attendance	Adult	Teen	Child
Current child care arrangements			✓
Paid child care	✓		
First 5 California: Kit for New Parents			✓
Preschool/school attendance, name of school		✓	✓
Preschool quality			✓
School instability		✓	
Employment	**Adult**	**Teen**	**Child**
Employment status, spouse's employment status	✓		
Hours worked at all jobs	✓		
Income	**Adult**	**Teen**	**Child**
Respondent's and spouse's earnings last month before taxes	✓		
Household income , number of persons supported by household income	✓		
Respondent characteristics	**Adult**	**Teen**	**Child**
Race and ethnicity, age, gender, height, weight	✓	✓	✓
Veteran status	✓		
Marital status, registered domestic partner status (same-sex couples)	✓		
Sexual orientation	✓		
Language spoken with peers, language of TV, radio, newspaper used	✓		
Education, English language proficiency	✓		
Citizenship, immigration status, country of birth, length of time in U.S., languages spoken at home	✓	✓	✓

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

81.1 percent of surname list sample numbers, and 94.3 percent of the AIAN list with landline numbers after removing nonworking and business numbers. Addresses were not available for the cell sample. As in all CHIS cycles since CHIS 2005, a $2 bill was included with the CHIS 2011-2012 advance letter to encourage cooperation.

The CHIS 2011-2012 screener response rate for the landline sample was 31.6 percent, and was higher for households that were sent the advance letter. For the cell phone sample, the screener response rate was 33.0 percent in all households. The extended interview response rate for the landline sample varied across the adult (47.4 percent), child (73.2 percent) and adolescent (42.7 percent) interviews. The adolescent rate includes getting permission from a parent or guardian. The adult interview response rate for the cell sample was 53.8 percent, the child rate was 73.4 percent, and the adolescent rate 42.6 percent. Multiplying the screener and extended rates gives an overall response rate for each type of interview. The percentage of households completing one or more of the extended interviews (adult, child, and/or adolescent) is a useful summary of the overall performance of the landline sample. For CHIS 2011-2012, the landline/list sample household response rate was 17.0 percent (the product of the screener response rate and the extended interview response rate at the household level of 53.9 percent). The cell sample household response rate was 18.3 percent, incorporating a household-level extended interview response rate of 55.5 percent. All of the household and person level response rates vary by sampling stratum. For more information about the CHIS 2011-2012 response rates please see *CHIS 2011-2012 Methodology Series: Report 4 – Response Rates*.

Historically, the CHIS response rates are comparable to response rates of other scientific telephone surveys in California, such as the California Behavioral Risk Factor Surveillance System (BRFSS) Survey. However, comparing the CHIS and BRFSS response rates requires recomputing the CHIS response rates so they match the BRFSS response rate calculation methods. The 2011 California BRFSS landline response rate is 37.4 percent, the cell phone response rate is 20.4 percent, and the combined landline and cell phone rate is 35.4 percent.[2] In contrast, the CHIS 2011-2012 landline response rate is 39.5, cell phone response rate is 32.1 percent, and the combined landline and cell phone response rate is 35.1 percent, all these computed using the BRFSS methodology. California as a whole and the state's urban areas in particular are among the most difficult parts of the nation in which to conduct telephone interviews. The 2011 BRFSS, for example, shows the refusal rate for the California (31.4%) is the highest in the nation and twice the national median (16.0%). Survey response rates tend to be lower in California than nationally, and over the past decade response rates have been declining both nationally and in California.

Further information about CHIS data quality and nonresponse bias is available at http://healthpolicy.ucla.edu/chis/design/Pages/data-quality.aspx.

After all follow-up attempts to complete the full questionnaire were exhausted, adults who completed at least approximately 80 percent of the questionnaire (i.e., through Section K which covers employment, income, poverty status, and food security), were counted as "complete." At least some responses in the employment and income series, or public program eligibility and food insecurity series were missing from those cases that did not complete the entire interview. They were imputed to enhance the analytic utility of the data.

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[2] As reported in the Behavioral Risk Factor Surveillance System 2011 Summary Data Quality Report (Version #5--Revised: 2/04/2013, available online at http://www.cdc.gov/brfss/pdf/2011_Summary_Data_Quality_Report.pdf.

Proxy interviews were conducted for frail and ill persons over the age of 65 who were unable to complete the extended adult interview in order to avoid biases for health estimates of elderly persons that might otherwise result. Eligible selected persons were re-contacted and offered a proxy option. For 283 elderly adults, a proxy interview was completed by either a spouse/partner or adult child. A reduced questionnaire, with questions identified as appropriate for a proxy respondent, was administered.

1.6 Weighting the Sample

To produce population estimates from CHIS data, weights are applied to the sample data to compensate for the probability of selection and a variety of other factors, some directly resulting from the design and administration of the survey. The sample is weighted to represent the non-institutionalized population for each sampling stratum and statewide. The weighting procedures used for CHIS 2011-2012 accomplish the following objectives:

- Compensate for differential probabilities of selection for households and persons;
- Reduce biases occurring because non-respondents may have different characteristics than respondents;
- Adjust, to the extent possible, for under-coverage in the sampling frames and in the conduct of the survey; and
- Reduce the variance of the estimates by using auxiliary information.

As part of the weighting process, a household weight was created for all households that completed the screener interview. This household weight is the product of the "base weight" (the inverse of the probability of selection of the telephone number) and a variety of adjustment factors. The household weight is used to compute a person-level weight, which includes adjustments for the within-household sampling of persons and nonresponse. The final step is to adjust the person-level weight using an iterative proportional fitting method or raking, as it is commonly called, so that the CHIS estimates are consistent with the marginal population control totals. This iterative procedure forces the CHIS weights to sum to known population control totals from an independent data source (see below). The procedure requires iteration to make sure all the control totals, or raking dimensions, are simultaneously satisfied within a pre-specified tolerance.

Population control totals of the number of persons by age, race, and sex at the stratum level for CHIS 2011-2012 were created primarily from the California Department of Finance's (DOF) 2012 Population Estimates and 2012 Population Projections. The raking procedure used 12 raking dimensions, which are combinations of demographic variables (age, sex, race, and ethnicity), geographic variables (county, Service Planning Area in Los Angeles County, and Health Region in San Diego County), household composition (presence of children and adolescents in the household), and socio-economic variables (home ownership and education). The socio-economic variables are included to reduce biases associated with excluding households without landline telephones from the sample frame. One limitation of using Department of Finance (DOF) data is that it includes about 2.4 percent of the population of California who live in "group quarters" (i.e., persons living with nine or more unrelated persons and includes, for example nursing homes, prisons, dormitories, etc.). These persons were excluded from the CHIS target population and, as a result, the number of persons living in group quarters was estimated and removed from the Department of Finance control totals prior to raking.

DOF control totals used to create the CHIS 2011-2012 weights are based on 2010 Census counts, while those in previous CHIS cycles were based on Census 2000 counts (with adjustments made by the Department of Finance). Please pay close attention when comparing estimates using CHIS 2011-2012 data with estimates using data from previous CHIS cycles. The most accurate California population figures are available when the US population count is conducted (every 10 years). Population-based surveys like CHIS must use estimates and projections based on the decennial population count data between Censuses. For example, population control totals for CHIS 2009 were based on DOF estimates and projections, which were based on Census 2000 counts with adjustments for demographic changes within the state between 2000 and 2009. These estimates become less accurate and more dependent on the models underlying the adjustments over time. Using the most recent Census population count information to create control totals for weighting produces the most statistically accurate population estimates for the current cycle, but it may produce unexpected increases or decreases in some survey estimates when comparing survey cycles that use 2000 Census-based information and 2010 Census-based information. See *CHIS 2011-2012 Methodology Series: Report 5 – Weighting and Variance Estimation* for more information on the weighting process.

1.7 Imputation Methods

Missing values in the CHIS data files were replaced through imputation for nearly every variable. This was a massive task designed to enhance the analytic utility of the files. Westat imputed missing values for those variables used in the weighting process and UCLA-CHPR staff imputed values for nearly all other variables.

Two different imputation procedures were used by Westat to fill in missing responses for items essential for weighting the data. The first imputation technique was a completely random selection from the observed distribution of respondents. This method was used only for a few variables when the percentage of the items missing was very small. The second technique was hot deck imputation without replacement. The hot deck approach is one of the most commonly used method for assigning values for missing responses. With a hot deck, a value reported by a respondent for a particular item is assigned or donated to a "similar" person who did not respond to that item. The characteristics defining "similar" vary for different variables. To carry out hot deck imputation, the respondents who answer a survey item form a pool of donors, while the item non-respondents are a group of recipients. A recipient is matched to the subset pool of donors based on household and individual characteristics. A value for the recipient is then randomly imputed from one of the donors in the pool. Once a donor is used, it is removed from the pool of donors for that variable. Hot deck imputation was used to impute the same items in CHIS 2003, CHIS 2005, CHIS 2007, CHIS 2009, and CHIS 2011-2012 (i.e., race, ethnicity, home ownership, and education).

UCLA-CHPR imputed missing values for nearly every variable in the data files other than those imputed by Westat and some sensitive variables in which nonresponse had its own meaning. Overall, item nonresponse rates in CHIS 2011-2012 were low, with most variables missing valid responses for less than 2% of the sample. However, there were a few exceptions where item nonresponse rate was greater than 20%, such as household income.

The imputation process conducted by UCLA-CHPR started with data editing, sometimes referred to as logical or relational imputation: for any missing value, a valid replacement value was sought based on known values of other variables of the same respondent or other sample(s) from the same household. For the remaining missing values, model-based hot-deck imputation with donor replacement was used. This method replaces a missing value for one respondent using a valid response from another respondent with similar characteristics as defined by a generalized linear model with a set of control variables (predictors). The link function of the model corresponds to the nature of the variable being imputed (e.g. linear regression for continuous variables, logistic regression for binary variables, etc.). Donors and recipients are grouped based on their predicted values from the model.

Control variables (predictors) used in the model to form donor pools for hot-decking always included the following: gender, age group, race/ethnicity, poverty level (based on household income), educational attainment, and region. Other control variables were also used depending on the nature of the imputed variable. Among the control variables, gender, age, race/ethnicity and regions were imputed by Westat. UCLA-CHPR then imputed household income and educational attainment in order to impute other variables. Household income, for example, was imputed using the hot-deck method within ranges from a set of auxiliary variables such as income range and/or poverty level.

The imputation order of the other variables followed the questionnaire. After all imputation procedures were complete, every step in the data quality control process is performed once again to ensure consistency between the imputed and non-imputed values on a case-by-case basis.

1.8 Methodology Report Series

A series of five methodology reports is available with more detail about the methods used in CHIS 2011-12:

- Report 1 – Sample Design;
- Report 2 – Data Collection Methods;
- Report 3 – Data Processing Procedures;
- Report 4 – Response Rates; and
- Report 5 – Weighting and Variance Estimation.

For further information on CHIS data and the methods used in the survey, visit the California Health Interview Survey Web site at http://www.chis.ucla.edu or contact CHIS at CHIS@ucla.edu.

2. WEIGHTING ADJUSTMENTS

This chapter introduces the concept of weighting and provides some background on the weights developed for analyzing CHIS 2011-2012 survey data. Weighting is a process that attempts to make estimates from survey respondents representative of the total population from which they were sampled by accounting for the chances of selecting units into the sample and making adjustments for imperfections in the frame and the data collection process. The process begins with a base weight that is then adjusted to account for additional stages of sampling, nonresponse and undercoverage.

As described in *CHIS 2011-2012 Methodology Series: Report 1 - Sample Design*, CHIS 2011-2012 has samples from three different types of sampling frames; landline, cellular, and lists. One set of weights was produced for data analysis, for the combined samples.

Although this chapter deals with the weights and their adjustments, it begins with the general reasons why fully adjusted weights should be used. It also describes the details, advantages, and disadvantages of weighting.

2.1 Weighting Approach

The approach used in CHIS 2011-2012 weighting is a standard design-based, multiple-frame methodology that is consistent with the sampling methods used during sample selection. The multiple-frame approach has been used since CHIS 2009 to combine and weight the landline, cell, and list telephone samples, and the landline and surname samples in previous cycles of CHIS.

The procedures used in CHIS are consistent for all users and analyses. Using the same analytic methods in a unified procedure also makes it much simpler for analysts to examine characteristics for many issues, such as preparing estimates from the main and supplemental samples for San Diego[3]. Operationally, the weighting steps are similar and can be applied at the same time across samples (whenever appropriate), streamlining the weighting process and reducing the time required to produce the weights.

Weights are applied to CHIS 2011-2012 sample data to estimate aggregate statistics at the state and county levels. In particular, sample weighting was carried out to accomplish the following objectives:

[3] There was a San Diego landline geographic supplemental sample in CHIS 2011-2012.

- Compensate for differential probabilities of selection and sampling rates for households and persons;
- Reduce biases occurring because nonrespondents may have different characteristics from respondents;
- Adjust, to the extent possible, for undercoverage in the sampling frames and in the conduct of the survey; and
- Reduce the variance of the estimates by using auxiliary information.

The combined landline/list/cell telephone sample weights were created to produce estimates that avoid the coverage bias of a landline-only sample that excludes cell-only households. As in previous cycles of CHIS a single weight was created for each adult, child, and adolescent completed interview in the samples.

2.2 Weighting Adjustments

The final weight for a completed CHIS interview is the product of a series of sequential adjustments. The starting point within each sampling stratum is the development of a base weight (Section 3.1), defined as the inverse of the probability of selection from the stratum frame. After creating the landline and surname list base weights (Section 3.1.1) and the cell phone base weights (Section 3.1.2) the base weights are adjusted for

- Remaining ported cell numbers not dialed (Section 3.2);
- Sampled telephone numbers never dialed (Section 3.3);
- Residual landline telephone numbers without full refusal conversion (Section 3.4);
- Unknown residential status (Section 3.5);
- Supplemental list sample eligibility (Section 3.6); Screener interview nonresponse (Section 3.7); and
- Multiple telephone numbers and duplicate respondent adjustments (Section 3.8).

These adjustments are described in Chapter 3.

The household weight is then adjusted to create a person weight for each type of extended interview. For the adult weights, the following factors are included:

- Probability of selection of the adult (Section 4.1);
- Extended adult interview nonresponse adjustment (Section 4.2);
- Telephone type adjustment (Section 4.3);
- Composite weight adjustment for combining the landline and cell phone samples (Section 4.3); and
- Trimming (Section 4.4) and raking (Section 4.5) adjustment to person-level control totals.

The child and adolescent weights are more complex because of the method used to sample children (see *CHIS 2011-2012 Methodology Series: Report 1 - Sample Design*). For these weights, the adjustment factors include:

- Section G adult extended interview nonresponse adjustment for households in which adolescents and children are sampled at the end of Section G of the adult interview (Section 5.1);
- Probability of selection of the child or adolescent (Sections 5.2 and 6.1);
- Extended child and adolescent interview nonresponse adjustment (Sections 5.3 and 6.2);
- Telephone type adjustment (Sections 5.3 and 6.2);
- Composite weight adjustment for combining the landline and cell phone samples (Sections 5.3 and 6.2); and
- Trimming and raking (Sections 5.3 and 6.2) adjustment to person-level control totals.

The expressions for the weighting factors and adjustments for the person weights are given in Chapters 4, 5, and 6. The derivation of the population control totals is described in Chapter 7. The imputation process and the variables imputed to support the weighting process are described in Chapter 8. Chapter 9 discusses methods for variance estimation for CHIS 2011-2012.

Appendix A contains tables showing the frame and sample sizes. Appendix B contains tables that show the effect of each step of the weighting process at the household and person levels. Throughout this report, we refer to specific tables and rows in Appendix B that indicate how the weights were adjusted.

2.3 Nonresponse Adjustments

In an ideal survey, all the units in the inference population are in the sample frame and all those in the sample participate in the survey. In practice, neither of these conditions occurs. Some units are not included in the frame (undercoverage) and some of the sampled units do not respond (nonresponse). If undercoverage and nonresponse are not addressed, then estimates from the survey may be biased. In CHIS 2011-2012, the weights of those who respond are adjusted to represent undercovered persons in the population and nonrespondents in the sample. The approaches used to account for these two sources of missing data begin with adjusting for nonresponse.

Nonresponse results in biases in survey estimates when the characteristics of respondents differ from those of nonrespondents. The size of the bias depends on the magnitude of this difference and the response rate (Groves, 1989). The purpose of adjusting for nonresponse is to reduce the bias. A weighting class adjustment method (Brick and Kalton, 1996) is the type of nonresponse adjustment procedure used in CHIS 2011-2012. In this procedure, nonresponse adjustment weights are computed and applied separately by cell, where a cell is defined using characteristics known for both nonrespondents and respondents. For example, the county associated with each telephone number is known, even if there are some misclassifications in the assignment. Thus, county can be used to define cells, and weighting adjustments can be computed separately for each of these cells. The more similar either response patterns or survey characteristics are within the cells, the larger the bias reduction in the adjustment.

The drawback to nonresponse adjustment is that it increases the variability of the weights and increases the sampling variance of the estimates (Kish, Weighting for unequal pi, 1992). A nonresponse adjustment is beneficial only when the reduction in bias more than compensates for the increase in variance. When the cells contain sufficient cases and the adjustment factors do not become inordinately large, the effect on variances is often modest. Large adjustment factors usually occur in cells with small numbers of respondents. To avoid this situation, cells with few cases are "collapsed" or combined to form a new cell with a larger number of cases.

The operational objective for nonresponse adjustment in CHIS 2011-2012 was to define adjustment cells for which response rates vary considerably and to avoid cells with either a small number of cases or a large adjustment factor. Since county-level estimates are important, the county was nearly always included in the definition of the cells. Oh and Scheuren (1983) discuss some of the statistical features associated with making these adjustments.

As noted above, nonresponse adjustment classes can be formed only if data are available for both responding and nonresponding units. Since the nonresponse adjustment is done for each stage of data collection, the data available for forming cells are different for each stage. For screening interviews, the nonresponse unit is a household (or more accurately a telephone number), and data must be available for all households. For extended interviews, the nonresponse adjustment is done by type of person (adult, child, or adolescent). At this level, data from the screening interview can be used to define cells.

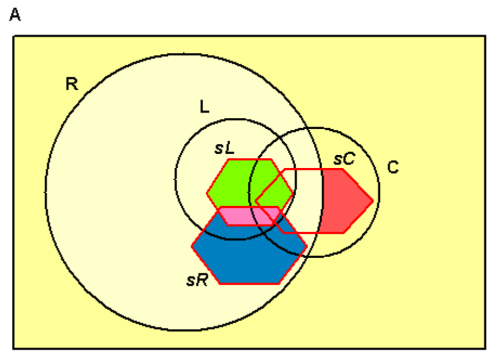
The approach to adjusting for undercoverage is somewhat different from that for nonresponse because noncovered units or persons were never eligible to be sampled. The undercoverage adjustment procedure uses data from external sources (control totals) in a process called poststratification (Holt & Smith, 1979). The primary objective of poststratification is to dampen potential biases arising from a combination of response errors, sampling frame undercoverage, and nonresponse. A secondary objective is to reduce sampling errors, which is important because CHIS 2011-2012 sample sizes within counties are fairly modest for some subclasses. In general, the sample is poststratified to as many independent figures as possible, subject to some constraints. In this discussion we use the term poststratification loosely and intend it to include raking, a form of multidimensional poststratification (Brackstone & Rao, 1979).In CHIS 2011-2012, the control totals are primarily derived from the 2012 California Department of Finance Population Estimates and Projections (State of California, Department of Finance, 2011, 2013), the 3-year 2009-2011 American Community Survey (U.S. Census Bureau, 2012), the Census 2010 Summary File 1 for California published by the U.S. Census Bureau (U.S. Census Bureau, 2012), and the Census 2010 Modified race Data (U.S. Census Bureau, 2012). Creation of the control totals at the person level is described in Chapter 7.

2.4 Combining Samples

In this section, we describe how the samples were combined to create the weights for CHIS 2011-2012. Before explaining the approach for combining the samples, we examine the relationship between the different frames and samples.

Consider the different samples as illustrated in Figure 2-1, which shows as an example the relationship for one stratum such as Los Angeles County.

Figure 2-1. Landline, list, and cell phone frames in CHIS 2011-2012



Note: The figure is not drawn to scale. The sizes of the samples relative to the frames are smaller than shown in the figure.

Let A be all eligible households in Los Angeles (LA) County (represented by the large yellow rectangle in the diagram). Let R (the large circle in the diagram) be all LA County households with telephone numbers in the landline frame, and L (smaller circle enclosed within R) be all LA County households with telephone numbers in the surname list frame. Note that by definition, R is included within A and that L is included within R (i.e., $L \subset R$). Let C be all LA County households with cell phone numbers, including those with no landline but with one or more cell phones (i.e., $C \cap \bar{R}$), and those with both types of telephone service (i.e., $C \cap R$). Notice that the cell frame, C, is not encompassed by R, but crosses both R and A. Let s_R, s_L, and s_C be households represented in the landline, surname list, and cell phone samples, respectively.

Thus far the discussion has focused on households, but the sampling frames are actually of telephone numbers. Consider now the list sample s_L and the landline sample s_R. By definition, all numbers in the surname frame L are contained in the landline frame R, so all numbers on the list or surname frame have two probabilities of selection (one from the landline sample and the other from the surname sample). Since the landline/surname and cell phone frames themselves do not overlap (although the households they represent do, as shown in Figure 2-1), the inclusion of the cell phone sample does not affect the probability of selection of telephone numbers from the landline and list samples. Thus, the landline and list samples can be weighted following the same methods used in previous cycles of CHIS. That is, the base weights depend on whether or not the telephone number was found on the surname frame. Whether any of the landline sample cases were on the surname frames is available from the surname list vendor. The expression of the base weights is described in more detail in Section 3.1.

As mentioned before, households with one or more cell phones only (i.e., $C \cap \bar{R}$) and households with both telephone services (i.e., $C \cap R$) were eligible in CHIS 2011-2012. Their base weights were computed as the inverse of the probability of selection from the respective frames. Operationally, the cellphone sample was weighted separately and at the same time as the landline sample, applying the appropriate weighting adjustments.

Since the landline and cell phone populations and samples overlap and the drawn samples are probability samples, we used a multiple-frame estimation approach to combine and create weights. This approach followed the ideas of Hartley (1962) and was different from the approach used to combine the landline and surname samples. This method was needed because the multiple probabilities of selection of all units in the sample from both frames could not be determined.

There are three population domains of interest in the overlapping frames. The first domain called a includes all adults in households with only landline service, the second domain called b includes all adults in cell-only households, and the third domain called ab includes all adults in households with both landline and cell phones. Let Y be a characteristic for adults in a domain (e.g., the number of adults with health insurance). Let $\hat{Y}^A$ be the estimate of Y computed using the landline sample, and let $\hat{Y}^B$ the estimate of Y computed using the records in cell phone sample. An estimate of Y using the landline sample is

$$\hat{Y}^A = \hat{Y}_a^A + \hat{Y}_{ab}^A ,$$

where $\hat{Y}_a^A$ is the estimate computed using the records from landline only households and $\hat{Y}_{ab}^A$ is the estimate computed using the adults with a landline and cell phone from in the landline sample. In a similar way, an estimate of Y based on the cell phone sample is $\hat{Y}^B = \hat{Y}_{ab}^B + \hat{Y}_b^B$ where $\hat{Y}_{ab}^B$ is the estimate computed using the adults with a landline and cell phone from the cell phone sample and $\hat{Y}_b^B$ is the estimate computed using the records from cell only households.

Notice that neither $\hat{Y}^A$ nor $\hat{Y}^B$ are unbiased estimates of Y. However, an unbiased estimate of Y can be computed as

$$\hat{Y} = \hat{Y}_a^A + \lambda\hat{Y}_{ab}^A + \left(1-\lambda\right)\hat{Y}_{ab}^B + \hat{Y}_b^B ,$$

where λ $(0 \le \lambda \le 1)$ is the composite or weighting factor. In CHIS 2011-2012, the value of λ was chosen to minimize the bias of $\hat{Y}$. The choice is outlined in Brick, Flores Cervantes, Lee, & Norman, (2011) and differs from the Hartley approach that minimizes the variance. In either approach, the estimates $\hat{Y}_a^A$, $\hat{Y}_{ab}^A$, $\hat{Y}_{ab}^B$, and $\hat{Y}_b^B$ are poststratified before creating the composite estimator.

In CHIS 2011-2012, a composite weight was created rather than requiring that calculation of every estimate from CHIS include the composite factor. In this approach the value of λ is attached to the weights. The composite weights can be used to compute estimates for any variable (although the value of optimal value of lambda depends of the characteristic Y). For example, the expression for the estimate $\hat{Y}$ becomes

$$\hat{Y} = \sum_{i \in a \in A} w_i y_i + \sum_{i \in ab \in A} w_i \lambda y_i + \sum_{i \in ab \in B} w_i \left(1-\lambda\right) y_i + \sum_{i \in b \in B} w_i y_i \ .$$

Since the landline/surname and cell phone samples were independent samples, the estimates of variance can be computed using replication or linearization (i.e., Taylor series approximation).

In summary, the supplemental samples (i.e., geographic and surnames samples) were combined with the landline sample at the beginning of the weighting process. The cell phone sample and the combined landline-supplemental samples were first poststratified to telephone service control totals, combined through a composite factor, and then raked all together. Details of these adjustments are described in the following sections.

3. HOUSEHOLD WEIGHTING

For all CHIS 2011-2012 samples, the first step in the weighting process is creating a household weight for each completed screener interview. The household weight is not used for analytical purposes because the only data captured at the household level in the screener interview are for sampling purposes. However, the household weight is a key element for the computation of the person weights (i.e., adult, child, and adolescent).

This chapter is divided into eight sections, each describing steps involved in creating the household weights. The first section reviews the creation of base weights. Subsequent sections describe the adjustments made to the base weights. These adjustments account for ported telephone numbers (numbers assigned to landline service that have been transferred to cell phones), sampled numbers that were not called, cases without full refusal conversion, unknown residential status, supplemental list sample eligibility, screener nonresponse, and households with multiple telephone numbers.

Knowledge of the sampling methods used in CHIS 2011-2012 is essential to understanding the weighting procedures. We assume anyone interested in the weighting procedures is already familiar with the sampling approach – details are in *CHIS 2011-2012 Methodology Series: Report 1 - Sample Design*.

3.1 Base Weights

A base weight is created for each sampling unit in the different CHIS samples. For the landline, list, and cell samples, the sampling unit is the telephone number.

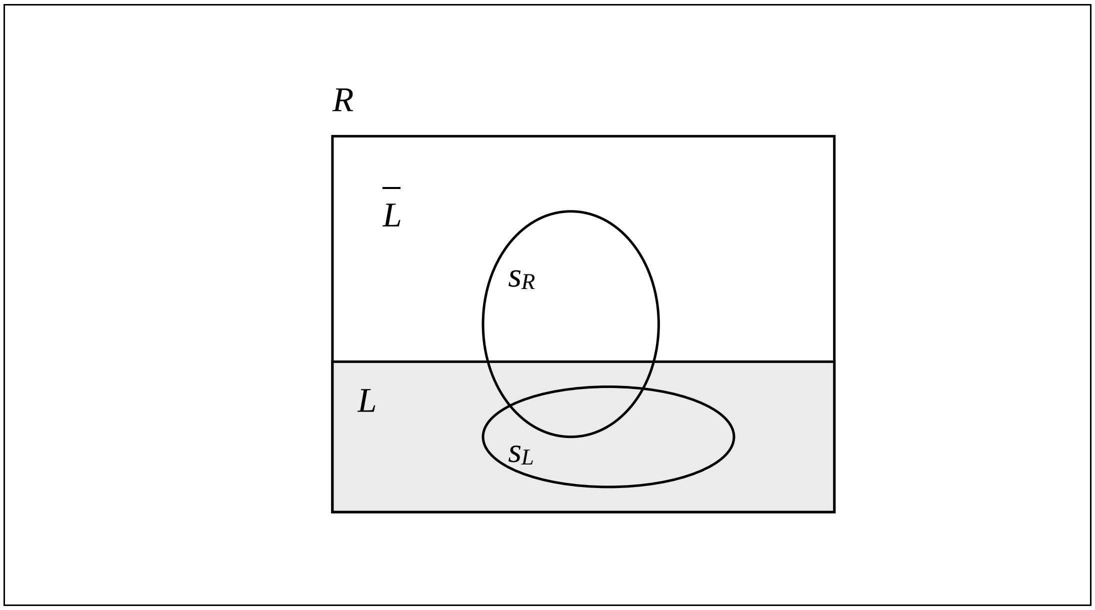
3.1.1 Landline and Surname List Base Weight

The base weight for the landline/list sample is computed as the inverse of the probability of selection of the telephone number. In CHIS 2011-2012, telephone numbers were drawn from the landline frame, three mutually exclusive surname frames (Korean only surname, Vietnamese only surname, and Korean and any other race/ethnic surname but Vietnamese surname) and from a list of American Indian/Alaska Native (AIAN) health clinic users[4]. The base weights reflect the multiple probabilities of selection of telephone numbers between the landline and different list frames.

[4]Cell phone numbers were also sampled from the AIAN list.

Figure 3-1 shows the relationship between the landline frame and a single list frame for a single sampling stratum. The figure also shows the relationship between the landline and list samples drawn from each frame. In order to create the household base weights, we consider all landline telephone households in California as either being on the list (L) or as only being eligible for sampling from the landline sample ($\bar{L}$) as shown in Figure 3-1. The relationships are discussed in detail below.

Figure 3-1. Relationship between the landline frame (R), landline sample (s_R),list frame (L), and list sample (s_L) for a single stratum



*The figure is not drawn to scale. The sizes of the list frame (L) and list and landline samples (s_L and s_R) are smaller than shown in the figure.

The notation in the figure follows:

R	the landline frame containing all telephone numbers;
L	the list frame (i.e., surnames or clinic users, and associated landline telephone numbers);
$\bar{L}$	all telephone numbers not found on the list – we assume that all the numbers in the list are found in R, and $R = L \cup \bar{L}$;
s_R	the simple random sample drawn from the frame R; and
s_L	the simple random sample drawn from the frame L.

We define the following:

N_R	the number of telephone numbers in the frame R ;
N_L	the number of telephone numbers in the frame L ;
n_R	the sample size (number of telephone numbers) of s_R ; and

n_L the sample size (number of telephone numbers) of s_L.

Notice that the landline sample s_R can be separated into two parts: s_{RL}, the portion of s_R that is found in the list (L), and $s_{R\bar{L}}$, the portion of s_R that is not found in the list $(\bar{L})$. The sample sizes for each portion are n_{RL} and $n_{R\bar{L}}$, respectively, and $n_R = n_{RL} + n_{R\bar{L}}$.

Consider L and $\bar{L}$ as two separate strata within the frame R. Since s_R is a simple random sample within R, the sample $s_{R\bar{L}}$ can be viewed as a simple random sample of size $n_{R\bar{L}}$ drawn from the $N_{\bar{L}}$ elements from stratum $\bar{L}$. Similarly, the sample s_{RL} can be viewed as a simple random sample of size n_{RL} drawn from the N_L elements from stratum L. In stratum L, there is a second sample s_L (the list sample). Since both samples s_L and s_{RL} are simple random samples, we can view them as a single sample of size $n_{RL} + n_L$ drawn from the N_L elements from stratum L. Notice that s_{RL} and s_L are not necessarily mutually exclusive; i.e., s_{RL} and s_L may contain duplicate telephone numbers. These numbers were removed from s_L during the sample selection.

The landline and list base weights can be expressed as follows:

- For sampled records that could only be sampled from the landline frame (landline numbers not found in the list L):

$$HHBW_{\bar{L}i} = \frac{N_{\bar{L}}}{n_{R\bar{L}}};$$

- For sampled records from the list and sampled records from the landline frame that are found in the list L (duplicate telephone numbers were eliminated from the list):

$$HHBW_{Li} = \frac{N_L}{n_{RL} + n_L}.$$

Creating these weights required classification of every telephone number by whether or not it was on the list irrespective of how it was sampled. It is easy to show that the resulting weights are composite weights derived by averaging the landline and list samples using a composite factor proportional to the sample sizes. Thus, this base weight produces an unbiased estimate in the traditional design-based framework.

The total telephone numbers in the landline frame and list frames (N_R and N_L) are computed separately. The landline sample was drawn using an RDD list-assisted approach from a stratified frame of

100 banks[5] with at least one listed telephone number in the state of California. Using this approach, a bank is drawn from the frame and two digits are randomly generated to complete the sampled telephone number. Therefore, the total number of telephone numbers in the landline frame in stratum h, N_{Rh}, is computed as

$$N_{Rh} = 100 \cdot \frac{NBANKS_{2011,h} + NBANKS_{2012,h}}{2},$$

where $NBANKS_{2011,h}$ and $NBANKS_{2012,h}$ are the number of 1+ banks in the stratum h in the 2011 and 2012 landline frames respectively. A "1+" bank is defined as a 100-bank with at least one listed telephone number.

Records on the list frames were assigned to landline sampling strata by linking telephone exchanges to the counties in the same way as for the landline sample. The list size by stratum (N_{Lh}) is the number of records in the list assigned to stratum h.

As described in CHIS 2011-2012 Methodology Series: Report 1 - Sample Design, the landline sample was drawn from strata defined as counties or groups of counties except for Los Angeles, San Diego, Orange, and Santa Clara. In Los Angeles County, 13 subsampling strata were created by the combination of areas with high/low concentration of Koreans and Vietnamese and eight Service Planning Areas (SPAs). Two substrata based on the concentration of Koreans and Vietnamese were created for San Diego, Orange, and Santa Clara Counties. The definition of the sampling strata and substrata, in addition to the number of telephone numbers in the landline frame, the number of sample cases, and base weights by frame type (landline, Korean only surname, Vietnamese only surname, Korean and another group but not Vietnamese surname, and AIAN lists), is shown in Appendix A, Table A-1. Table B-1 in Appendix B (rows 1.1 through 1.3) lists the sample counts, sums of base weights, and coefficients of variation by sampling stratum for these samples.

3.1.2 Cell Phone Base Weight

Similar to the landline sample, the cell phone sample had a main sample drawn from a cell phone frame supplemented with cell phone numbers drawn from a list of American Indian/Alaska Native (AIAN) health clinic users associated with cell phone numbers. The cell phone sample was drawn for a

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[5] A bank is defined as 100 consecutive telephone numbers with the same first eight digits including area code.

stratified random sample of 1,000-series blocks dedicated to wireless service (NXXTYPE types 04, 55, 60) or PCS (personal communication service types 65, 68)[6]. The sampling strata were defined by the area code of telephone numbers assigned to wireless service and pre-assigned FIPS county code. The AIAN cell phone sample was part of a supplemental sample used to increase the number of American Indian/Alaska Native interviews in CHIS 2011-2012. For more details on the cell phone samples, see *CHIS 2011-2012 Methodology Series: Report 1 - Sample Design*.

The cell sample base weight, which combines the RDD cell phone sample with cell phone numbers from the AIAN list and reflects the additional probability of selection of the cell phone numbers in the list, is computed in the same way as the landline/list base weight described in Section 3.1.1. The only difference is that the total number of telephone numbers in the cell phone frame in stratum *h* is computed using 1,000 blocks in stratum *h*. Note that the stratum definition for the cell phone sample is different from that of the landline sample in that they do not match the same areas as in the landline sample for most strata, and they do not include consideration of Los Angeles SPAs, San Diego health regions, and relative concentrations of Koreans and Vietnamese in high density counties.

The definitions of the sampling strata and substrata, in addition to the number of telephone numbers in the cell phone frame and AIAN frame, the sample sizes, and average base weights, are shown in Appendix A, Table A-2. Table B-1 in Appendix B (rows 1.1 through 1.3) lists the sample counts, sums of base weights, and coefficients of variation by sampling stratum for the main cell phone sample.

3.2 Ported Telephone Number Adjustment

Telephone numbers sampled as part of the landline sample but identified as cell phone numbers during the purging process were dialed as part of the cell sample in CHIS 2011-2012. However, since the cell sample target was met before the end of data collection, some ported telephone numbers were not dialed. The weights of ported numbers that were dialed were adjusted to account for ported numbers from the landline sample not dialed. In this adjustment, the dialed ported numbers were assumed to be a random sampled of all ported telephone numbers identified in the landline sample. The ported telephone adjusted weight, $HHA1W_i$, is computed as

$$HHA1W_i = HHA1F_i * HHBW_i,$$

[6] There are some additional technical restrictions in the sampling, such as making sure the number can be dialed into and that toll-free numbers are excluded.

where $HHA1F_i$ is the ported telephone number adjustment factor computed as:

$$HHA1F_i = \begin{cases} \dfrac{\sum\limits_{i \in CDIALED, CN\_DIALED} HHBSW_i}{\sum\limits_{i \in CDIALED} HHBSW_i} & \text{If } i \in CDIALED \\ 0 & \text{If } i \in N\_CDIALED \end{cases},$$

where the group *CDIALED* denotes dialed cell phone numbers identified as ported in the landline sample, *N_CDIALED* denotes those that were not dialed. This adjustment is done separately by sampling stratum. This adjustment was not applied to numbers selected from the cell phone frame, so the adjustment factor $HHA1F_i$ was set to one for all records in this sample. Table B-1 in Appendix B (rows 2.1 through 2.4) shows the sum of weights before and after the adjustment.

3.3 New Work Adjustment

Additional telephone numbers were drawn during data collection depending on the number of completed interviews achieved to date and the projected number of completed interviews at the end of the data collection period. However, not all newly drawn telephone numbers were dialed because the targets in some strata were met before exhausting the sample. In this adjustment, the weights were adjusted to account for sampled numbers that were not dialed. The dialed telephone numbers were assumed to be a random sample of all drawn telephone numbers. The new work telephone adjusted weight, $HHA2W_i$, is computed as

$$HHA2W_i = HHA2F_i * HHA1W_i,$$

where $HHA2F_i$ is the new work adjustment factor computed as:

$$HHA2F_i = \begin{cases} \dfrac{\sum\limits_{i \in DIALED.N\_DIALED} HHA1W_i}{\sum\limits_{i \in DIALED} HHA1W_i} & \text{If } i \in DIALED \\ 0 & \text{If } i \in N\_DIALED \end{cases},$$

where the group *DIALED* denotes dialed telephone numbers and *N_DIALED* denotes those that were not. This adjustment is very small and was done separately by sampling stratum and mailable status. This adjustment was applied to telephone numbers in the landline and list samples. The adjustment factor

$HHA2F_i$ was set to one for all records in the cell phone sample. Table B-1 in Appendix B (rows 3.1 through 3.4) shows the sum of weights before and after the adjustment.

3.4 Refusal Conversion Adjustment

Subsampling for refusal conversion was a technique used in CHIS 2003, 2005, and 2007. It was used in households in which a member refuses to participate in the study at the screener level; shifting some resources from the less productive, labor-intensive task of refusal conversion to the more productive task of completing extended interviews increased the efficiency of data collection. Due to changes over time in the relative efficiency of different kinds of work, subsampling for refusal conversion was not implemented in CHIS 2009 and 2011-2012, and all refusals in the landline and surname samples were eligible for two refusal conversion attempts at the screener level if neither refusal was judged to be hostile or abusive. Starting in CHIS 2011-2012, second refusal conversion was also implemented for the cell sample. However, towards the end of the field period, additional telephone numbers were released in selected strata to meet the targets for the number of completed interviews. In some instances, no or only one refusal conversion was attempted because the protocol could not be implemented before the end of the data collection period. In this adjustment, the weights of the cases with two refusal conversion attempts were adjusted to account for the few cases that have none or only one refusal conversion. It is assumed that refusals without refusal conversion attempts were a random sample of those with refusal conversion attempts in this adjustment.

This adjustment did not affect cases from the cell sample or surname samples because all refusals in these samples followed the standard protocol. Therefore this adjustment factor was equal to one for those samples.

Before adjusting the weights for screener interview refusal subsampling, telephone numbers were classified into screener refusal groups using their refusal status (i.e., whether the respondent ever refused) and the value of the refusal conversion flag as shown in Table 3-1.

Table 3-1. Screener refusal groups for landline sample

Screener refusal group	Respondent ever refused screener interview?	First Refusal Subsampling Flag	Second Refusal Subsampling Flag	Description
NRef	No	N/A	N/A	Households where respondent did not refuse the screener interview (includes complete and incomplete screener interviews)
RefC1	Yes	Yes	No	Households where respondent refused the screener interview and only first refusal conversion procedures were used
RefC2	Yes	Yes	Yes	Households where respondent refused the screener interview and both first and second refusal conversion procedures were used
RefNC	Yes	No	No	Households where respondent refused the screener interview and refusal conversion procedures were not used

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The first refusal subsampling adjusted weight, $HHA3W_i$, is:

$$HHA3W_i = HHA3F_i * HHA2W_i$$

where $HHA3F_i$ is the first refusal subsampling adjustment factor computed as:

$$HHA3F_i = \begin{cases} \dfrac{\sum\limits_{i \in (RefC1, RefNC)} HHA2W_i}{\sum\limits_{i \in RefC1} HHA2W_i} & \text{If } i \in RefC1 \\ 0 & \text{If } i \in RefNC \\ 1 & \text{If } i \in RefNC \end{cases},$$

where the groups $RefC1$, $RefNC$, and $NRef$ are defined in Table 3-1, $HHA2W_i$ is the new work adjusted weight, and $\delta_i(c)$ is 1 if the number is in sampling stratum *c* and is zero otherwise.

The second refusal subsampling adjusted weight, $HHA4W_i$, is:

$$HHA3W_i = HHA4F_i * HHA3W_i$$

where $HHA2F_i$ is the second refusal subsampling adjustment factor computed as:

$$HHA4F_i = \begin{cases} \dfrac{\sum_{i \in (RefC2, RefNC1)} HHA3W_i}{\sum_{i \in RefC2} HHA3W_i} & \text{If } i \in RefC2 \\ 0 & \text{If } i \in RefNC \\ 1 & \text{If } i \in NRef \end{cases},$$

where the groups $RefC2$, $RefNC$, and $NRef$ are defined in Table 3-1. Table B-1 in Appendix B (rows 4.1 through 5.4) shows the sum of the weights before and after the refusal conversion subsampling adjustments.

3.5 Unknown Residential Status Adjustment

Telephone numbers with unknown residential status are those that could not be classified by residential status at the end of data collection despite being dialed many times. They are telephone numbers with only answering machine results or some combination of answering machine and ring no answer results (screener disposition code of *NM*) or all ring no answer results (screener disposition of *NA*). Before adjusting the weights to account for telephone numbers with unknown residential status, the proportion of eligible residential telephone numbers among those numbers with unknown residential status was estimated. This estimate was also used in the computation of the response rates described in *CHIS 2001-2012 Methodology Series: Report 4 - Response Rates*.

In CHIS 2011-2012, the estimated proportion of unknown residential telephone numbers considered residential (p_{res}) was computed separately for the landline, surname, and cell phone samples. The proportion p_{res} was computed following the CASRO recommendation (Council of American Survey Research Organizations, 1982) as the proportion of the resolved or observed sample units that are residential. Since telephone numbers were sampled with different selection probabilities and were adjusted differentially for refusal conversion, the weighted number of telephone numbers was used rather than the number of cases (unweighted) to compute p_{res}. This use of weights also compensates for the under- and oversampling implemented in different geographic areas.

Table 3-2 shows the values of p_{res} for the landline sample, calculated separately for each combination of mail status, urbanicity, and how the answering machine result was coded by interviewers. As expected, the estimated proportion of residential households is much lower for answering machines coded as "possible nonresidential" compared to those coded as "possible residential." For example, in urban strata among mailable cases, the estimated proportion of residential households with mailable addresses and answering machine results coded as possible residential is 94.0 percent, while the estimated proportion of those coded possible nonresidential is 20.4 percent. The lowest percentages of residential telephone numbers are for the numbers that were not mailable and had answering machine messages coded as possible nonresidential or unknown.

Table 3-2. Estimated residential proportion for the landline sample

Mail status	Urban status	Answering machine code	p_{res}
Mailable	Urban	No machine	0.668
Mailable	Urban	Possible residential	0.907
Mailable	Urban	Possible nonresidential	0.257
Mailable	Urban	Unknown	0.846
Mailable	Not urban	No machine	0.713
Mailable	Not urban	Possible residential	0.901
Mailable	Not urban	Possible nonresidential	0.230
Mailable	Not urban	Unknown	0.853
Not mailable	Urban	No machine	0.233
Not mailable	Urban	Possible residential	0.861
Not mailable	Urban	Possible nonresidential	0.110
Not mailable	Urban	Unknown	0.581
Not mailable	Not urban	No machine	0.251
Not mailable	Not urban	Possible residential	0.860
Not mailable	Not urban	Possible nonresidential	0.095
Not mailable	Not urban	Unknown	0.557

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Table 3-3 shows the values of p_{res} for the list samples. Since there were no differences by type of list sample, the values of p_{res} were computed combining the cases from the lists.

Table 3-3. Estimated residential proportion for the list samples

Answering machine code	p_{res}
No machine	0.442
Answering machine possible residential	0.891
Answering machine possible nonresidential	0.155
Answering machine unknown	0.747

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Table 3-4 shows the values of p_{res} for the cell phone sample. This proportion was computed by sampling stratum.

Table 3-4. Estimated residential proportion for the cell phone samples by sampling strata

Sampling stratum	Counties covered	p_{res}
1	Los Angeles	0.543
2	San Diego	0.551
3	Orange	0.604
4	Santa Clara	0.643
5	San Bernardino	0.544
6	Riverside	0.558
7	Alameda	0.574
8	Sacramento, Placer	0.625
9	Contra Costa	0.643
10	Fresno, Tulare, Kings, Madera	0.600
11	San Francisco	0.683
12	Ventura	0.527
13	San Mateo	0.615
14	Kern	0.620
15	San Joaquin, Stanislaus, Merced	0.547
16	Sonoma, Solano, Napa	0.641
18	Santa Barbara	0.582
21	Santa Cruz	0.664
22	San Francisco, Marin	0.611
23	San Luis Obispo	0.615
26	Butte, Tehama, Glenn, Colusa	0.564
27	Shasta	0.633
28	Yolo, El Dorado, Nevada, Sutter, Yuba	0.612
30	San Diego, Imperial	0.574
34	Monterey, San Benito	0.612
35	Humboldt, Mendocino, Lake	0.577
43	Del Norte, Siskiyou, Trinity, Modoc, Lassen, Plumas, Sierra	0.530
44	Amador, Alpine, Calaveras, Tuolumne, Mariposa, Mono, Inyo	0.384

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The estimated proportion of residential households among the unknown residential telephone numbers or addresses p_{res} is then used to adjust the weights for unknown residential status. The residential status adjusted weight, $HHA5W_i$, is

$$HHA5W_i = HHA5F_i * HHA4W_i,$$

where $HHA5F_i$ is the unknown residential status adjustment factor computed as:

$$HHA5F_i = \begin{cases} \dfrac{\sum_{i \in RES} HHA4W_i + \sum_{i \in UNK\_RES} p_{res} * HHA4W_i}{\sum_{i \in RES} HHA4W_i} & \text{If } i \in RES \\ 0 & \text{If } i \in UNK\_RES \end{cases},$$

where the group *RES* denotes telephone numbers identified as residential and *UNK_RES* denotes telephone numbers with unknown residential status.

This adjustment is done separately by sample type. In the landline sample, the adjustment is done within sampling stratum by mailable status. In the list sample, the adjustment is by list type (i.e., surname and AIAN list). This adjustment was not applied to the cell phone sample even though Table 3-4 shows that there were differences between the ported and wireless assigned cell phones. The adjustment factor $HHA3F_i$ was set to one for all records in this sample. Table B-1 in Appendix B (rows 6.1 through 6.5) shows the sum of weights before and after making the adjustment for unknown residential status for the landline, surname, and cell sample.

3.6 Sample Eligibility Nonresponse Adjustment

After the unknown residential status adjustment, the weights are adjusted for eligibility in the samples where screening is used to identify eligible respondents. In CHIS 2011-2012, screening was used only to identify households with adults of Korean, Vietnamese, or American Indian/ Alaska Native descent in the surname samples. Therefore, this adjustment is only applicable to these samples.

The weights were adjusted to account for households in which the ethnic origin or race of the adults (i.e., whether Korean, Vietnamese or AIAN) could not be determined. Telephone numbers from the list samples were eligible only if one or more adults in the household considered themselves of Korean, Vietnamese or AIAN descent.[7]

Households with at least one adult from one of these groups are referred to as "list-eligible" households. If a household from the supplemental sample was found to be list-eligible, then one adult from these groups was selected for the extended interview. If the household was not list-eligible (i.e., no adults of Korean, Vietnamese or AIAN descent), then the screener interview was terminated and the case was coded as a list-ineligible.

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[7] Question SC6A1 of the screener interview asked, "Do any of these adults who live in your household consider themselves to be {Korean or Vietnamese or of Korean or Vietnamese} {American Indian or Alaska Native or of American Indian or Alaska Native} descent?"

Screening on eligibility and retaining only list-eligible households in the supplemental list samples was a relatively efficient method for increasing the number of Korean, Vietnamese or AIAN extended interviews in CHIS 2011-2012 and previous cycles. The information on the ethnic origin or race of the adults was used to avoid unnecessary interviews of adults from a different group, who were represented adequately in the landline sample.

Household list eligibility could not be determined for nonresponding households in the surname list samples, and the weights had to be adjusted for unknown list eligibility. The weights of the households with unknown list eligibility were distributed between the list-eligible and ineligible households in the surname samples. The assumption in this adjustment was that the proportion of list-eligible/ineligible households among the households with unknown list eligibility was the same as the observed proportion in the sample with known eligibility. The cases were classified in response groups as indicated in Table 3-5.

Table 3-5. List eligibility response groups

List eligibility response status group		Description
L_E	List-eligible	Household from the list sample with at least one list-eligible adult (i.e., adult of Korean, Vietnamese or AIAN descent).
L_IN	List-ineligible	Household from the list sample without any list-eligible adult (i.e., no adults of Korean, Vietnamese or AIAN descent).
L_UNK	List eligibility unknown	Household from the list sample where the eligibility of the adults could not be determined.
L_NA	List eligibility not screened	Household from all other samples (not screened for eligible ethnicity).

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The list eligibility nonresponse adjusted household weight, $HHA5W_i$, is computed as

$$HHA6W_i = HHA6F_c * HHA5W_i \,,$$

where $HHA6F_c$ is the list eligibility nonresponse adjustment factor computed as

$$HHA6F_c = \begin{cases} \dfrac{\sum\limits_{i \in L\_E, L\_IN, L\_UNK} HHA5W_i \delta(c)}{\sum\limits_{i \in L\_E, L\_IN} HHA5W_i \delta(c)} & \text{If } i \in L\_E, L\_IN \\ 0 & \text{If } i \in L\_UNK \\ 1 & \text{If } i \in L\_NA \end{cases} ,$$

where the groups *L_E*, *L_IN*, *L_UNK*, and *L_NA* are defined in Table 3-4, and $\delta_i(c)$ is 1 if the number is in list eligibility nonresponse adjustment cell *c* and is zero otherwise. The nonresponse adjustment cells correspond to the list sample type (i.e., Korean, Vietnamese, Korean-other, and AIAN samples). Table B-1 in Appendix B (rows 7.1 through 7.4) shows the sum of weights before and after the list eligibility nonresponse adjustment.

3.7 Screener Nonresponse Adjustment

In this step, the household weight is adjusted to account for households that did not complete the screener interview. The nonresponse adjustment cells were created separately for the main landline and surname list samples and utilized information on the presence of children in the household from the screener[8].

In the first step of screener nonresponse adjustment we adjusted the weights to account for the presence of children in the household. The weights of nonresponding households with a known child status were distributed to responding households. This weight, $HHA7W_i$, is:

$$HHA7W_i = HHA7F_c * HHA6W_i,$$

where $HHA7F_c$ is the unknown presence of children adjustment factor computed as

$$HHA7F_i = \begin{cases} \dfrac{\sum_{i \in SC\_KCS, SC\_UCS} HHA6W_i \delta_i(c)}{\sum_{i \in SC\_KCS} HHA6W_i \delta_i(c)} & \text{If } i \in SC\_KCS \\ 0 & \text{If } i \in SC\_UCS \end{cases}$$

where the group *SC_KCS* is the set of screener respondents with known child presence status, and *SC_UCS* is the set of screener nonrespondents with unknown child status, and $\delta_i(c)$ is 1 if the number is in screener nonresponse adjustment cell c and is zero otherwise. Table B-1 in Appendix B (rows 8.1 through 8.4) shows the sum of weights before and after the unknown presence of children in household adjustment.

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[8] There are differences in response rates between households with and without children. See *CHIS 2011-2012 Methodology Series: Report 4– Response Rates.*

In the second step of screener nonresponse adjustment we adjusted the weights to account for screener nonresponse among households with a known presence of children. This weight, $HHA8W_i$, is:

$$HHA8W_i = HHA8F_c * HHA7W_i,$$

where $HHA8F_c$ is the screener nonresponse adjustment factor computed as

$$HHA8F_c = \begin{cases} \dfrac{\sum\limits_{i \in SC\_R, SC\_NR} HHA7W_i \delta_i(c)}{\sum\limits_{i \in SC\_R} HHA7W_i \delta_i(c)} & \text{If } i \in SC\_R \\ 0 & \text{If } i \in SC\_NR \end{cases},$$

where the group *SC_R* is the set of screener respondents, and *SC_NR* is the set of screener nonrespondents, and $\delta_i(c)$ is 1 if the number is in screener nonresponse adjustment cell *c* and is zero otherwise.

List-ineligible households (i.e., households with no adults of Korean, Vietnamese or AIAN origin) from the surname list samples (group *R_IN* defined in the previous section) were considered as screener nonrespondents (group *SC_NR*) in this adjustment. Although these cases were households with only list-ineligible adults, they still represented households with eligible adults for the landline sample extended interview who were screened out. Table B-1 in Appendix B (rows 9.1 through 9.4) shows the sum of weights before and after the screener nonresponse adjustment.

3.8 Multiple Telephone and Duplicate Respondent Adjustments

At the end of the screener interview for the landline sample, information about the existence of additional landline telephone numbers and their use in the household was collected. If more than one landline telephone number is used for residential purposes (not solely for business, fax or computer use, etc.), the household has a greater probability of selection because it could have been selected through any of the additional telephone numbers in the household. In such cases, the household weight is adjusted to reflect the increased probability of selection. The multiple telephone adjusted household weight, $HHA9W_i$, is computed as:

$$HHA9W_i = HHA9F_c * HHA8W_i,$$

where $HHA9F_c$ is the multiple telephone adjustment factor computed as:

$$HHA9F_c = \begin{cases} 0.5 & \text{If household } i \text{ has more than one residential telephone number} \\ 1 & \text{Otherwise} \end{cases}.$$

In this adjustment, we assume that there is at most one additional residential-use landline telephone number in the household. Table B-1 in Appendix B (rows 10.1 through 10.5) identifies the sum of weights before and after the multiple telephone adjustment. This adjustment was not applied to the cell sample and therefore the adjustment factor was set to 1 in this step.

After adjusting the weights for the increased probability of selection due to multiple landline telephones, the weights were first adjusted for households that were sampled through different landline telephones (i.e., different telephone numbers for the same household). Since respondents were not interviewed twice, the second attempted interview was coded as a duplicate number. Since these numbers represent the same household, the weight of the first interview is adjusted to account for the second attempted interview. In this step, the weight for the duplicate was distributed to the completed screener. The duplicate respondent adjustment factor $ODF1_i$ was computed as:

$$ODF1_i = \begin{cases} \dfrac{HHA9W_{Complete} + HHA9W_{Duplicate}}{HHA9W_{Complete}} & \text{Landline completed interview with duplicate} \\ 0 & \text{Landline duplicate respondent} \\ 1 & \text{Otherwise} \end{cases}$$

In other cases, respondents were contacted by different telephone types (landline and cell phone). In these cases the weight of the duplicate respondent was distributed to the non-duplicate numbers within sampling stratum. In this case, the second duplicate respondent adjustment factor $ODF2_i$ was computed as:

$$ODF2_1 = \begin{cases} \dfrac{\sum_{i \in c} HHA9W_i}{\sum_{i \in c \text{ and it is not duplictae}} HHA9W_i} & \text{Duplicate respondent with completed interveiw} \\ 0 & \text{Duplicate respondent} \\ 1 & \text{Otherwise} \end{cases}$$

The household weight adjusted for duplicate respondents, $HHA10W_i$, is computed as

$$HHA10W_i = HHA10F0_i * HHA9W_i.$$

where the overall duplicate respondent factor $HHA10F_i$ adjustment factor was computed as $HHA10F0_i = ODF1_i * ODF2_i$. Table B-1 in Appendix B (rows 11.1 through 11.2) identifies the sum of weights before and after this adjustment.

4. ADULT WEIGHTING

A final weight was created for each adult who completed the adult extended interview.[9] The initial adult weight is the product of the final household weight and the reciprocal of the probability of selecting the adult from all adults in the household for the landline and surname samples. For the cell phone sample, the initial weight is the product of the final household weight and the number of adults in the household where the cell phone is shared; if the cell phone is not shared, the initial adult weight equals the final household weight. In subsequent steps, the initial adult weight is adjusted for nonresponse. Before raking the weights to known control totals, the achieved landline and cell phone samples are poststratified to controls by telephone use. After this step, a composite weight combining the landline and cell phone samples was created. Undercoverage of adults that could not be interviewed because they reside in households without a landline or cell phone was compensated for by a raking adjustment that included a dimension to reduce the undercoverage bias.

4.1 Adult Initial Weight

As described in *CHIS 2011-2012 Methodology Series: Report 1 - Sample Design*, one adult was sampled with equal probability from all adults in the household using the Rizzo method (Rizzo, Brick, & Park, 2004). The initial adult weight is the product of the final household weight and the inverse of the probability of selection of the adult. The expression for the adult initial weight, $ADA0W_j$, is

$$ADA0W_i = ADCNT_i \cdot HHA9W_i ,$$

where $ADCNT_i$ is the total number of adults in household *i* for the landline and surname samples and the number of adults in the household (if there are adults that share the sampled phone) for the cell phone sample, and $HHA9W_i$ is the multiple-telephone-adjusted weight described in the previous chapter.

This scheme for the cell phone sample assumes that, in cell phone households with more than one adult, each adult has a cell phone (or shares a different cell phone) if the sampled cell phone is not shared. If the cell phone is shared, we assume that all adults in the household share that phone. Appendix B, Table B-2 (rows 1.1 through 1.3) shows the number of adults, sum of initial weights, and coefficient of variation for the landline and cell samples for the state.

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[9] Adult extended interviews are considered complete provided the adult completed through table K on employment and income.

4.2 Adult Nonresponse Adjustment

Regardless of the sample, some households completed the screener interview but the sampled adult did not complete the extended adult interview. In addition, in a few cases it was discovered during the extended interview that the sampled person was under 18 years of age and hence ineligible. To account for both sampled adults who did not complete the extended interview and for ineligible sampled persons, the adult initial weight was adjusted for extended interview nonresponse. Prior to making the adjustment, we classified extended interviews into response groups as indicated in Table 4-1.

Table 4-1. Extended interview response groups

Response status group		Description
ER	Eligible respondent	Adult who completed the extended interview
IN	Ineligible	Ineligible person
UNK	Unknown eligibility	Sampled adult could not be contacted and eligibility verified for extended interview

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The adult nonresponse adjusted weight, $ADA1W_i$, is computed as

$$ADA1W_i = ADA1F_c \cdot ADA0W_i \,,$$

where $ADA1F_c$ is the adult nonresponse adjustment factor given by

$$ADA1F_c = \begin{cases} \dfrac{\sum\limits_{i \in (ER,IN,UNK)} ADA0W_i \cdot \delta_i(c)}{\sum\limits_{i \in (ER,IN)} ADA0W_i \cdot \delta_i(c)} & i \in (ER, IN) \\ 0 & i \in UNK \end{cases} \,,$$

where *ER*, *ENR* and *IN* are defined in Table 4-1, *c* indicates the adult extended interview nonresponse adjustment cell, and $\delta_i(c) = 1$ if the adult belongs to cell *c* and is zero otherwise.

Table 4-2 lists the variables that were considered in defining the nonresponse adjustment cells. All of these have been examined in previous CHIS cycles. A nonresponse analysis showed that sex, child-first interview status, age group, and whether the sampled adult was also the screener respondent were the best variables for creating nonresponse cells. Nonresponse cells with fewer than 30 respondents or with large adjustment factors were combined with adjacent cells. All the cells were created within sampling stratum. Appendix B Table B-2 (rows 2.1 through 2.5) shows the sum of weights before and after the nonresponse adjustment, for the landline and cell phone samples. Ineligible persons were dropped following this weighting step.

Table 4-2. Variables used for the creation of nonresponse adjustment cells for the adult weights

Variable		Levels
Sex of adult respondent	1.	Male
	2.	Female
Child-first interview	1.	Child-first procedures in affect
	2.	Child-first procedures not in affect
Adult age group	1.	18-30 years old
	2.	31-45 years old
	3.	46-65 years old
	4.	65 years or older
Adult screener Respondent	1.	Sampled adult was screener respondent
	2.	Sampled adult was not screener respondent

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

4.3 Composite Weight

The next step in weighting was to combine the landline and cell samples. Before creating the composite weights, both samples were poststratified separately to control totals defined by type of telephone service (i.e., persons in landline only households, persons in cell-phone-only households, and persons in households with both services). The distribution of telephone usage for California was derived from the National Health Interview Survey for January to June 2012 for the U.S. West region. The poststratified person weight, $PPERW_j$ is computed as

$$PPERW_j = \frac{TEL\_USAGE\_CT_i}{\sum PERW_j} * PERW_j$$

where $PERW_j$ is the person weight (i.e., adult, and child/adolescent) and $TEL\_SERVICE\_CT_i$ is the control total by telephone service (landline only, cell phone only, both services). Appendix B, Table B-5 (rows 1.1 through 1.3) shows the sum of weights before and after this adjustment.

Once the samples were poststratified, a composite weight that combined the landline and cell phone samples was created. Based on research by Brick, Flores Cervantes, Lee, & Norman (2011), the composite factor $\lambda = 0.75$ was used to reduce the bias of estimates computed from the combined sample. This factor and its complement ($1-\lambda$) can be seen as additional weighting adjustment factors to apply to the poststratified weights. The expression of the composite weight, $COMBW_j$, is

$$
COMBW_j = \begin{cases} PPERW_j & \text{If person } i \text{ lives in a household with cell only or landline only} \\ \lambda * PPERW_j & \text{If person } i \text{ lives in a household with cell and landline from the landline sample} \\ (1-\lambda) * PPERW_j & \text{If person } i \text{ lives in a household with cell and landline from the cell sample} \end{cases}
$$

where $PPERW_j$ is the poststratified person weight above. Table B-5 in Appendix B (row 2.1) shows the sum of weights before and after this adjustment.

4.4 Adult Trimming Factors

Before benchmarking the adult weights to the known total of adults in California in 2012, we examined the distribution of the composite weights to determine if there were very large weights with a large effect on either the estimates or their variances. When observations with large weights were found, the weights for these cases were reduced in a process called trimming.

As in previous cycles, we computed statistics to identify influential weights that were candidates for trimming. These statistics and other variations were studied in detail in Liu, Ferraro, Wilson, & Brick, (2004). The first statistic is a function of spacing of the weights. Let $w_{(1)},\ldots,w_{(n)}$ be the order statistics for the adult weights $w_1,\ldots,w_n$ and define "spacing" z_i as the distance (difference) between a ranked weight $w_{(i)}$ and the next ranked weight $w_{(i-1)}$ (i.e., $z_i = w_{(i)} - w_{(i-1)}$). The statistic $d5\_space_i$ for a ranked $w_{(i)}$ is defined as

$$
d5\_space_i = \frac{z_i}{z_{i-1} + z_{i-2} + z_{i-3} + z_{i-4} + z_{i-5}} .
$$

The second statistic used computes the distance between a weight and the next largest weight relative to the size of the weight. The statistic is

$$
rel\_space_i = \frac{z_i}{w_{(i)}} \times 10 .
$$

We also computed a third statistic defined as

$$diff\_dist_i = distance_i - distance_{i-1},$$

where $distance_i$ is the relative distance for the weight $w_{(i)}$ computed as

$$distance_i = \frac{\left|w_{(i)} - median\left(\mathbf{w}\right)\right|}{MAD},$$

where $\mathbf{w} = \left(w_i, ..., w_n\right)^t$ and the median absolute deviation $MAD = median\left(\left|w_i - median\left(\mathbf{w}\right)\right|\right)$.

The three statistics for the largest 20 weights in each stratum were examined separately. When all three statistics were greater than 1 then the case was a primary candidate for trimming. The final decision on trimming was based on the distribution of weights within sampling stratum.

The trimmed weight $TRMW_i$ is computed as

$$TRMW_i = TFACT_i * PPERW_i,$$

where $TFACT_i$ is the trimming factor for the sampled adult *i* given by

$$TFACT_i = \begin{cases} 1 & \text{if the weight } i \text{ is not trimmed} \\ t_i & \text{otherwise} \end{cases}$$

where $0 < t_i < 1$.

For the adult extended interview 54 records were trimmed[10]. The trimming factor ranged between 0. 2265 and 0.9971. Table B-5 (rows 2.1 and 3-1 to 3-3) in Appendix B shows trimmed weights by self-reported stratum and the sum of weights before and after trimming for the different weights.

[10] The trimming was done prior to the raking adjustment; however, it was an iterative process. After the trimming and raking, the distribution of the weights was re-examined, and new decisions were made about trimming. This might have changed the decision about which weights should be trimmed or the magnitude of the trimming factor. If a revision was made, the trimmed and raked weights were discarded and new trimming and raking were undertaken. The number of trimmed weights reported here is at the completion of the overall process.

4.5 Adult Raked Weight

The next step in adult weighting was raking the trimmed weights to population control totals to produce estimates consistent with the 2012 California Department of Finance (DOF) Population Estimates. Included in the raking adjustment is an undercoverage adjustment for adults in households without a telephone. The specific control totals and the method used to create them are described in Chapter 7.

Raking is a commonly used estimation procedure in which estimates are controlled to marginal population totals. It can be thought of as a multidimensional poststratification procedure because the weights are poststratified to one set (i.e., a dimension) of control totals, then these adjusted weights are poststratified to another dimension. The procedure continues until all dimensions are adjusted. The process is then iterated until the control totals for all dimensions are simultaneously satisfied (at least within a specified tolerance). Raking is also described in more detail in Chapter 7.

The adult raked weight, $RAKEDW_i$, can be expressed as

$$RAKEDW_i = TRMW_i \cdot \prod_{k=1}^{K} RAKEDF_{k_l} ,$$

where $RAKEDF_{k_l}$ is the raking factor for dimension *k*, level *l* in which adult *i* belongs. For example, if the 4th dimension (*k* =4) is sex with two levels (*l*=1 for male and *l*=2 for female), then the raking factor for this dimension is $RAKEDF_{4_1}$ for the adult male. The raking factors are derived so the following relationship holds for every raking dimension *k*, and level *l*,

$$CNT_{k_l} = \sum_i \delta(k_l)_i \cdot RAKEDW_i ,$$

where CNT_{k_l} is the control total, and $\delta(k_l)_i = 1$ if the adult *i* is in level *l* of dimension *k* and zero otherwise.

The weights, which include landline and cell sample weights, were raked to known control totals for California. Table B-5 (rows 3.3 and 4.1 to 4.5) in Appendix B shows the sum of weights before and after this raking adjustment.

5. CHILD WEIGHTING

A final child weight was created for all completed child extended interviews. In CHIS 2009 and CHIS 2011-2012, unlike CHIS 2007, children (and adolescents) were selected in the cell phone sample. The steps for the child weighting are similar to those for adults described in the previous chapter. One exception is an additional weighting adjustment needed to account for nonresponse in a section of the adult interview where the majority of the children were sampled. A more complete discussion of this adjustment is found in Section 5.1. The format of this chapter follows that for the adult weighting, with the creation of the child initial weights and the adjustments for nonresponse, telephone use poststratification, composite weight, trimming, and raking.

5.1 Household-Level Adjustment

The main difference between the child (and adolescent) weighting procedures and those for adults is that adults were always sampled in the screener. Children and adolescents could be selected at the end of the screener interview or in Section G of the adult extended interview. The selection of children at the end of the screener interview is called the child-first procedure. Weights for children and adolescents selected in Section G must be further adjusted to account for nonresponse at the adult interview level. On the other hand, weights of the child-first children and adolescents were not adjusted for adult nonresponse.

Telephone numbers were classified into completion groups (*SECGST*) by Section G completion status and their child-first interview status as shown in Table 5-1.

Table 5-1. Section G completion groups

Section G completion group (*SECGST*)	Child-first interview?	Section G completed by adult?	Description
C1st	Yes	N/A	Households with child-first procedures
NC1stGC	No	Yes	Households without child-first procedures and section G was completed
NC1stGNC	No	No	Households without child-first procedures and section G was not completed

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

To account for adults who did not complete Section G of the adult interview (hence, no child or adolescent could be sampled), the household final weight $HHA9W_i$ was adjusted. We refer to this adjusted weight as the Section G adjusted household weight, $HHA10W_i$, and it is

$$HHA10W_i = HHA10F_c * HHA9W_i ,$$

where

$$HHA10F_i = \begin{cases} \dfrac{\sum_{i \in NC1stGC,\ NC1stGNC} HHA9W_i \delta(c)}{\sum_{i \in NC1stGC} HHA9W_i \delta(c)} & \text{If } i \in NC1stGC \\ 0 & \text{If } i \in NC1stGNC \\ 1 & \text{If } i \in C1st \end{cases} ,$$

and where the section G completion groups *C1st*, *NC1stGC*, and *NC1stGNC* are defined in Table 5-1, c denotes the Section G nonresponse adjustment cell, and $\delta_i(c) = 1$ if the adult belongs to cell c and is zero otherwise. Following this adjustment, the weights were positive for all households with sampled adults who completed section G and either completed, partially completed, or did not complete the adult interview[11]. Note that this adjustment can be considered an additional adjustment to the household weight. Table B-1 in Appendix B (rows 12.1 through 12.2) identifies the sum of weights before and after this adjustment.

The Section G nonresponse adjustment cells were created within sampling strata using a combination of the mailable status (known address/mailed letter, unknown address) and the presence of children and/or adolescents, collected during the screener interview.

5.2 Initial Child Weight

The initial child weight is the product of the adjusted household weight and the probability of sampling the child within the household. The selection of the child was done in two steps. In the first step, one adult was randomly selected among all adults in the household. In the second step, one child was randomly selected among all the children associated with the sampled adult (i.e., the sampled adult is the parent or legal guardian of the child). If the sampled adult did not have an associated child, then no child was sampled even if there were children present in the household. See *CHIS 2011-2012 Methodology*

[11] If the adult interview was not completed or was only partially completed in a case that did not use the child-first procedure, no attempt was made to complete a child/teen interview.

Series: Report 1 - Sample Design for additional information on the within-household person selection process.

Since the selection of a child within a household depends on the relationships among children and adults within the household, these relationships were defined before sampling children. The probability of selection reflects the fact that the sampled child could have been selected through the spouse/partner of the sampled adult if both are the parents or legal guardians[12] of the sampled child. Accordingly, the initial child weight, $CHA0W_j$, is

$$CHA0W_j = \frac{1}{CHPROB_j} HHA10W_i ,$$

where $HHA10W_i$ is the section G adjusted weight, $CHPROB_j$ is the probability of selecting the j^{th} child associated with the i^{th} sampled adult and is relatively complex. If the sampled adult does not have a spouse/partner living in the household or if the spouse/partner of the sampled adult is not the parent or legal guardian of the sampled child, then

$$CHPROB_j = \frac{1}{ADLTCNT} \cdot \frac{SACHMOS_j}{\sum_j SACHMOS_j}$$

where $ADLTCNT$ is the number of adults in the household and $SACHMOS_j$ is the measure of size of child *j*. The measure of size for a child is discussed in detail in *CHIS 2011-2012 Methodology Series: Report 1 - Sample Design*, but we note here that within the same household children age 0 to 5 years have a measure of size twice that of children age 6 to 11 years. If the sampled adult has a spouse/partner living in the household and the spouse/partner of the sampled adult is the parent or legal guardian of the sampled child then

$$CHPROB_j = \frac{1}{ADLTCNT} \left(\frac{SACHMOS_j}{\sum_j SACHMOS_j} + \frac{SACHMOS_j}{\sum_k SPCHMOS_k} \right)$$

[12] If the spouse/partner of the sampled adult is living in the household.

where $ADLTCNT$ and $SACHMOS_j$ are defined as before and $SPCHMOS_k$ the measure of size child k associated with the spouse/partner of the sample adult. The number of sampled children and sum of the initial weights are in Table B-3 (rows 1.1 through 1.3) in Appendix B.

5.3 Other Child Weighting Adjustments

Adjustments to the child weights included one for extended interview nonresponse, telephone service poststratification, construction of composite weights, trimming influential weights, and raking to control totals. The child nonresponse adjustment is the same as the adult nonresponse adjustment described in Section 4.2, except the adjustment cells are defined differently. We initially created child nonresponse adjustment cells using three variables: household mailable status, sex of child, and age group (0-3, 4-7, and 8-11 years old) within sampling stratum. Since a majority of these cells had fewer than 30 respondents, we collapsed cells to increase the number of respondents in each cell. To do this we inspected adjustment factors separately by mailable status, sex, and age group at the state level to determine the variables with the most variable response rates. Using these results, for two sampling strata mailable status, sex and age group were used, and for the rest of the sampling strata the cells were defined by sampling stratum, sex of child, and age group. Any cells still containing fewer than 30 respondents were collapsed over age group. The two strata with smallest sample sizes were collapsed across both sex and age group. Table B-3 (rows 2.1 through 2.3) in Appendix B shows the number of sample records and sum of weights before and after the nonresponse adjustments.

The next step in weighting was to combine the landline and cell samples. As for the adult weights, child and adolescent interviews from the landline/surname and cell phone samples were poststratified separately to control totals defined by telephone type. Table B-6 (rows 1.1 through 1.3) in Appendix B shows the sum of weights before and after this adjustment.

In the next step, the landline and cell phone sample were combined using a composite factor. We used the same composite factor $\lambda = 0.75$ as in the adult sample to reduce the bias of estimates computed using both samples. Table B-6 (row 2.1) in Appendix B shows the sum of weights after this adjustment.

The next step was to identify and trim large child weights. The process used for trimming the adult weights was applied to the child weights. As a result of applying the procedures, we identified and trimmed a total of 67 child weights in CHIS 2011-2012. The trimming factors range from 0.1196 to

0.7405. Appendix B Table B-6 (rows 2.1 and 3.1 through 3.3) shows the distribution of trimmed weights by self-reported stratum and the sum of the weights before and after applying the trimming factors.

The trimmed child weights were then raked to population control totals to produce estimates consistent with the California Department of Finance 2012 population estimates. See Chapter 7 for the specific controls used. The expression for the raking adjustment is the same as that for adult weights described in Section 4.5. Appendix B Table B-6 (rows 3.3 and 4.1 through 4.5) shows the counts and sum of weights before and after the raking adjustments.

6. ADOLESCENT WEIGHTING

In CHIS 2011-2012, adolescents were sampled and responded to the interview for themselves after parental permission was obtained to conduct the interview. In this section, we describe the creation of analytic weights for the adolescent interview. The steps for the adolescent weighting are similar to those for children described in the previous chapter. The format of this chapter follows that for the child weighting, with the creation of the adolescent initial weights and the adjustments for nonresponse, telephone service poststratification, composite weight, trimming, and raking.

6.1 Initial Adolescent Weights

The procedures for creating the adolescent weights are the same as those for creating the child weights described in Chapter 5. As with the child weighting, the initial weights for the adolescents incorporate the probability of sampling the adult and the probability of sampling an adolescent among the adolescents associated with the sampled adult. The initial weight, $TNA0W_i$, is computed as

$$TNA0W_j = \frac{1}{TNPROB_j} HHA10W_i ,$$

where $HHA10W_i$ is defined in Chapter 5, and $TNPROB_i$ is computed in the same way as $CHPROB_i$ in Section 5.2. However, the measure of size is unity for all adolescents regardless of their age. Appendix B Table B-4 shows the number of sampled adolescents (row 1.1) and the sum of the initial adolescent weights (row 1.2).

6.2 Other Adolescent Weighting Adjustments

The adolescent initial weight was then adjusted for nonresponse the same way the adult and child initial weights were adjusted. Note that nonresponse for the adolescent interview includes failure to obtain permission for the interview, as well as failure to interview the adolescent once permission was obtained. Table B-4 in Appendix B shows the nonresponse-adjusted adolescent weight. Initially the adolescent nonresponse adjustment cells were created using the household mailable status, sex of the adolescent, and age group (12-14 and 15-17 years old) within sampling stratum. We inspected response rates separately by the three variables at the state level to determine the most important variables and the order of collapsing. After reviewing these rates, we created cells using sampling stratum, mailable status, sex and age group. Cells containing fewer than 30 respondents were collapsed across age group first and then across mailable status and sex if necessary.

The next step in weighting was to combine the landline and cell samples. As in the adult weights, child and adolescent weights from the landline/surname and cell phone samples were poststratified separately to control totals defined by telephone service. Appendix B, Table B-7 (rows 1.1 through 1.3) shows the sum of weights before and after this adjustment.

After poststratification, the landline and cell phone samples were combined using a composite factor. We used the same composite factor $\lambda = 0.75$ as in the adult sample to reduce the bias of estimates computed using both samples. Appendix B, Table B-7 (row 2.1) shows the sum of weights after this adjustment.

After the creating the composite weight, 56 influential weights were identified and trimmed, with factors ranging from 0.1158 to 0.9995. Appendix B Table B-7 (rows 2.1 and 3.1 through 3.3) gives the trimmed weights by self-reported stratum and the sum of the weights before and after applying the trimming factors to the adolescent weights.

In the last steps, the adolescent weights were raked to California DOF 2012 Population Estimates. See Chapter 7 for details on the control totals. The expression for the raking adjustment is the same as in the raking of the adult weights and the child weights (see Section 4.5). Appendix B Table B-7 (rows 3.3 and 4.2) show the sum of weights before and after raking.

7. RAKING AND CONTROL TOTALS

This chapter describes the raking procedure and the development of control totals for CHIS 2011-2012. The first section gives a general overview of raking and why this procedure was used in this and previous cycles of CHIS. The second section describes the 12 dimensions used to rake the weights. The remaining sections describes the sources for deriving the control totals and how these control totals were derived.

7.1 Raking Procedure

Raking is an adjustment procedure in which estimates are controlled to marginal population totals. The main advantage of raking over poststratification is that raking allows the use of more auxiliary information. A limitation in poststratification is that each unit falls into only one adjustment cell and the number of respondents in a cell could be too small. With raking, the cell size is based on the distribution of each raking dimension. For example, with poststratification, only some cross-classified age/race/sex categories could be used in the adjustments, whereas with raking the full cross-classification is not needed, and important geographic data such as county can be included as dimensions. Raking may be thought of as a multidimensional poststratification procedure because the weights are basically poststratified to one set (a dimension) of control totals, then these adjusted weights are poststratified to another dimension. After all dimensions are adjusted, the process is iterated until the control totals for all the dimensions are simultaneously satisfied within a specified tolerance. Raking was also used in previous cycles of CHIS. Below, we describe the procedure in more detail. Brackstone & Rao, (1979); Deville & Särndal, (1992); and Kalton & Flores Cervantes, (2003) also describe raking.

For simplicity, consider two auxiliary variables (or dimensions) with C and D classes, respectively. If we cross-classify the two variables into $C*D$ cells and the sample counts in some cells are small, then it is likely that the poststratified estimates may be unstable unless the cells in the cross-tabulation are collapsed. With the 12 dimensions used in CHIS 2011-2012, the potential collapsing would be very extensive.

An alternative approach is to rake the weights to the marginal totals of the variables. The raking-adjusted estimator is design-unbiased in large samples and is very efficient in reducing the variance of the estimates if the estimates in the cross-tabulation are consistent with a model that ignores the interactions between variables. Collapsing is sometimes required with raking, but it is not as extensive as with poststratification.

The raked weights can be written as $\tilde{w}_{cd,i} = w_{cd}\hat{\alpha}_c\hat{\beta}_d$, where w_{cd} is the pre-raked weight of an observation in cell (*c*, *d*) of the cross-tabulation, $\hat{\alpha}_c$ is the effect of the first variable, and $\hat{\beta}_d$ is the effect of the second variable. Note that in this formulation there is no interaction effect; the weights are determined by the marginal distributions of the control variables. As a result, the sample sizes of the marginal distributions are the important determinants of the stability of the weighting procedure, not the cells formed by the cross-classification of the variables. Deficient cells (cells with small sample sizes) are thus defined in terms of the sample sizes of the marginal distributions, not of the cross-classified cells.

7.2 Raking Dimensions

The 12 dimensions used in CHIS 2011-2012 are shown in Table 7-1. The first 8 dimensions and the 12th dimension in Table 7-1 were created by combining demographic variables (age, sex, race, and ethnicity) and different geographic areas (county, region or group of counties, region, and state). The 9th, 10th, and 11th dimensions use additional variables. The 11th dimension was specifically created to adjust the weights for households without a landline telephone. Section 7.3 describes this adjustment and the variables used to create the levels for this dimension. The raking dimensions for CHIS 2011-2012 are similar to those used in previous CHIS cycles.

Table 7-1. Definitions of the dimensions used in raking

Dimension	Level	Description	Categories	
1	Region (R) (collapsed where necessary)	Age groups (3) x Sex (2)	11R	Under 12 years, male
			12R	Under 12 years, female
			21R	12 to 17 years, male
			22R	12 to 17 years, female
			31R	18 years or older, male
			32R	18 years or older, female

See note at end of table.

Table 7-1. Definitions of the dimensions used in raking (continued)

Dimension	Level	Description	Categories	
2	Region (R) (collapsed where necessary)	Age groups (9)	R1	Under 6 years
			R2	6 to 11 years
			R3	12 to 17 years
			R4	18 to 24 years
			R5	25 to 29 years
			R6	30 to 39 years
			R7	40 to 49 years
			R8	50 to 64 years
			R9	65 years or older
3	State	Age groups (13) x Sex (2)	11	Under 4 years, male
			12	Under 4 years, female
			21	4 to 7 years, male
			22	4 to 7 years, female
			31	8 to 11 years, male
			32	8 to 11 years, female
			41	12 to 14 years, male
			42	12 to 14 years, female
			51	15 to 17 years, male
			52	15 to 17 years, female
			61	18 to 24 years, male
			62	18 to 24 years, female
			71	25 to 30 years, male
			72	25 to 30 years, female
			81	31 to 37 years, male
			82	31 to 37 years, female
			91	38 to 45 years, male
			92	38 to 45 years, female
			101	46 to 53 years, male
			102	46 to 53 years, female
			111	54 to 64 years, male
			112	54 to 64 years, female
			121	65 to 77 years, male
			122	65 to 77 years, female
			131	78 years or older, male
			132	78 years or older, female
4	SPAs in Los Angeles Co., HRs in San Diego Co., Remainder of CA	SPAs (8), HRs (6), Remainder of CA (1)	0	Remainder of CA
			11	SPA 1 – Antelope Valley
			12	SPA 2 – San Fernando
			13	SPA 3 – San Gabriel
			14	SPA 4 – Metro
			15	SPA 5 – West
			16	SPA 6 – South
			17	SPA 7 – East
			18	SPA 8 – South Bay

Table 7-1. Definitions of the dimensions used in raking (continued)

Dimension	Level	Description	Categories	
4	SPAs in Los Angeles Co., HRs in San Diego Co., Remainder of CA	SPAs (8), HRs (6), Remainder of CA (1)	21	HR 1 – North Coastal
			22	HR 2 – North Central
			23	HR 3 – Central
			24	HR 4 – South
			25	HR 5 – East
			26	HR 6 – North Inland
5	Region (R) (collapsed where necessary)	Race/ethnicity (7)	1	Under 12 years old (whole state)
			2	12 to 17 years old (whole state)
			1R	Latino 18 years old or older
			2R	Non-Latino White 18 years old or older
			3R	Non-Latino African American 18 years old or older
			4R	Non-Latino American Indian 18 years old or older
			5R	Non-Latino Asian 18 years old or older
			6R	Non-Latino Native Hawaiian 18 years old or older
			7R	Non-Latino Two or more races 18 years old or older
6	State	Race/ethnicity (7) x Age groups (2) x Gender (2) (collapsed where necessary)	111	Latino, Male, under 18 years
			112	Latino, Male, 18 years or older
			121	Latino, Female, under 18 years
			122	Latino, Female, 18 years or older
			211	Non-Latino White, Male, under 18 years
			212	Non-Latino White, Male, 18 years or older
			221	Non-Latino White, Female, under 18 years
			222	Non-Latino White, Female, 18 years or older
			311	Non-Latino African American, Male, under 18 years
			312	Non-Latino African American, Male, 18 years or older
			321	Non-Latino African American, Female, under 18 years
			322	Non-Latino African American, Female, 18 years or older
			411	Non-Latino American Indian, Male, under 18 years
			412	Non-Latino American Indian, Male, 18 years or older
			421	Non-Latino American Indian, Female, under 18 years
			422	Non-Latino American Indian, Female, 18 years or older
			511	Non-Latino Asian, Male, under 18 years
			512	Non-Latino Asian, Male, 18 years or older
			521	Non-Latino Asian, Female, under 18 years
			522	Non-Latino Asian, Female, 18 years or older

Table 7-1. Definitions of the dimensions used in raking (continued)

Dimension	Level	Description	Categories	
6	State	Race/ethnicity (7) x Age groups (2) x Gender (2) (collapsed where necessary)	611	Non-Latino Native Hawaiian, Male, under 18 years
			612	Non-Latino Native Hawaiian, Male, 18 years or older
			621	Non-Latino Native Hawaiian, Female, under 18 years
			622	Non-Latino Native Hawaiian, Female, 18 years or older
			711	Non-Latino Two or more races, Male, under 18 years
			712	Non-Latino Two or more races, Male, 18 years or older
			721	Non-Latino Two or more races, Female, under 18 years
			722	Non-Latino Two or more races, Female, 18 years or older
7	State	Asian groups (5) x Age groups (2)	11	Non-Latino Chinese only, under 18 years
			12	Non-Latino Chinese only, 18 years or older
			21	Non-Latino Korean only, under 18 years
			22	Non-Latino Korean only, 18 years or older
			31	Non-Latino Filipino only, under 18 years
			32	Non-Latino Filipino only, 18 years or older
			41	Non-Latino Vietnamese only, under 18 years
			42	Non-Latino Vietnamese only, 18 years or older
			51	Other or non-Asian only, under 18 years
			52	Other or non-Asian only, 18 years or older
8	Stratum (S) (collapsed where necessary)	Race/ethnicity (3) x Age groups (2)	S11	Latino, under 18 years
			S12	Latino, 18 years or older
			S21	Non-Latino White, under 18 years
			S22	Non-Latino White, 18 years or older
			S31	Non-Latino Non-White, under 18 years
			S32	Non-Latino Non-White, 18 years or older
9	Region (R) (collapsed where necessary)	Education (4)	R1	Not applicable (age < 18 years)
			R2	Less than High School
			R3	High School grad or GED recipient
			R4	At least some college
10	Region (R) (collapsed where necessary)	Person type (3) x # Adults in HH (3)	11R	Adult, 0 or 1 adult
			12R	Adult, 2 adults
			13R	Adult, 3 or more adults
			21R	Child, 0 or 1 adult
			22R	Child, 2 adults
			23R	Child, 3 or more adults
			31R	Teen, 0 or 1 adult
			32R	Teen, 2 adults
			33R	Teen, 3 or more adults

Table 7-1. Definitions of the dimensions used in raking (continued)

Dimension	Level	Description	Categories	
11	Region(collapsed where necessary)	Non-telephone dimension		See Table 7-3
12	Region (7) x Stratum (S)	Person type (3)	RSS1 RSS2 RSS3	Child Teen Adult

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Before raking the weights, dimensions with levels or cells with fewer than 50 respondents were collapsed with "adjacent" levels to form larger cells. Cells in dimensions defined at the stratum level were collapsed within the geographic regions shown in Table 7-2. Cells of dimensions defined at the region level were collapsed across regions if the regions did not contain enough respondents. Dimensions 3, 6, and 7 were defined at the state level because there were too few respondents in many of the cells at smaller geographic levels. Dimensions 9, 10 and 11 were defined at the region level because the control totals needed to create these cells (education and type of household defined by number of adults in the household) were not available at the county level. When collapsing the cells, we ensured that there was at least one cell or a group of cells within each self-reported stratum. In this way, the raked weights summed to the total number of persons in each stratum.

Table 7-2. Regions in California

Region	Counties
Northern & Sierra Counties	Butte, Shasta, Humboldt, Lake, Mendocino, Yuba, Nevada, Sutter, Colusa, Glenn, Tehama, Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, Trinity, Alpine, Amador, Calaveras, Inyo, Mariposa, Mono. Tuolumne
Greater Bay Area	Santa Clara, Alameda, Contra Costa, San Francisco, San Mateo, Sonoma, Solano, Marin, Napa
Sacramento Area	Sacramento, Placer, Yolo, El Dorado
San Joaquin Valley	Fresno, Kern, San Joaquin, Stanislaus, Tulare, Merced, Kings, Madera
Central Coast	Ventura, Santa Barbara, Santa Cruz, San Luis Obispo, Monterey, San Benito
Los Angeles	Los Angeles
Other Southern California	San Diego, Orange, San Bernardino, Riverside, Imperial

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

7.3 Non-Telephone Raking Dimension

CHIS 2011-2012 included both landline and cell phone samples so respondents with at least one telephone type have a chance of being selected. However, there is potential for bias from undercoverage from households without any telephone service if there are differences in characteristics of the persons residing in households with telephones and those without. CHIS 2011-2012 includes a nontelephone adjustment focused on reducing the potential bias introduced by exclusion of nontelephone households from the survey. This adjustment was carried out through a raking dimension at the person level (dimension 11). The control totals were derived for the same cells using the 2012 California Department of Finance (DOF) Population Estimates and Population Projections and the 2009-2011 American Community Survey public use micro data file (ACS-PUMS) (U.S. Census Bureau, 2012). Table 7-3 shows the definition of the cells of dimension 11.

Table 7-3. Dimension 11, non-telephone adjustment cell definition for CHIS 2011-2012

Dimension 11 levels	Stratum	Household tenure	Age in years	Educational attainment	Number of adults in the household
1R101	Region (R)	Own	0 to 17	NA	0 or 1
2R101		Rent	0 to 17	NA	0 or 1
1R102		Own	0 to 17	NA	2 or more
2R102		Rent	0 to 17	NA	2 or more
1R210		Own	18 to 30	Up to high school	NA
1R310		Own	31 to 64	Up to high school	NA
1R410		Own	65 and older	Up to high school	NA
1R220		Own	18 to 30	Greater than high school	NA
1R320		Own	31 to 64	Greater than high school	NA
1R420		Own	65 and older	Greater than high school	NA
2R210		Rent	18 to 34	Up to high school	NA
2R311		Rent	35 and older	Up to high school	0 or 1
2R312		Rent	35 and older	Up to high school	2 or more
2R220		Rent	18 to 34	Greater than high school	NA
2R321		Rent	35 and older	Greater than high school	0 or 1
2R322		Rent	35 and older	Greater than high school	2 or more

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

7.4 Raking Factors

Table 7-4 shows the overall and relative raking adjustment factors for the adult, child, and adolescent weights for the combined landline/list and cell phone samples. The overall adjustment factors were computed as the ratio of the control total to the sum of weights before raking. The factors in the table can only be compared to the CHIS 2009 weights because these weights have similar weighting adjustments (Sections 4.3, 5.3, and 6.2) which were not used in earlier cycles. Further, because of the telephone use poststratification, the raking factors cannot be used as a measure of person-level undercoverage at the state level. Nevertheless, they may be used as an indicator of which groups were harder to reach, or were less likely to complete the interview. Larger adjustment factors suggest relative undercoverage and smaller factors relative overcoverage.

Table 7-4. Overall adjustment raking factors for adult, child, and adolescent interviews by sample characteristics

Characteristic	Adult	Child	Adolescent
Sex			
Male	1.053	0.999	1.102
Female	0.952	0.953	0.995
Age group			
Under 5 years		0.983	
6 – 11 years		0.969	
12 – 17 years			1.047
18-24 years	1.063		
25-29 years	1.274		
30-39 years	1.242		
40-49 years	1.072		
50-64 years	0.858		
65 years and over	0.809		
Race/Ethnicity[a]			
Latino	1.175	1.045	1.110
Non-Latino			
White alone	0.841	0.817	0.893
African American alone	0.985	0.980	1.102
American Indian/Alaska Native alone	0.754	1.877	0.884
Asian alone	1.299	1.306	1.421
Native Hawaiian and Other Pacific Islander alone	1.873	1.585	2.064
Two or more races	0.943	0.747	0.882

Table 7-4. Overall adjustment raking factors for adult, child, and adolescent interviews by sample characteristics (continued)

Characteristic	Adult	Child	Adolescent
Non-Latino Asian ethnic groups			
Chinese only	1.250	1.268	1.451
Korean only	1.001	1.224	1.162
Filipino only	1.938	2.791	2.604
Vietnamese only	1.151	1.501	1.460
Educational Attainment			
Not applicable (age < 18 years)		0.976	1.047
Less than High School,	1.260		
High School grad or GED recipient,	1.041		
Some college	0.950		
College degree or above	0.918		
Household Tenure [a]			
Owner	1.066	1.033	1.084
Renter	0.916	0.932	0.999
Number of adults in the household [b]			
One	0.776	1.220	1.257
Two	0.921	0.891	1.027
Three or more	1.222	1.118	1.009
Number of children in the household [b]			
None	0.958		1.023
One	1.139	1.058	1.083
Two or more	1.169	0.936	1.089
Number of adolescents in the household [b]			
None	0.983	0.974	
One	1.087	0.999	1.086
Two or more	1.112	0.937	1.003

[a] OMB race ethnicity

[b] Person level estimate by type of household

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Table 7-4 shows that for adults, the adjustment factor for males is larger than for females, which is common in telephone surveys. The factors also suggest that younger adults (under 50 years old), and adults who own their home, adults in households with three or more adults, adults in households with at least one child or adolescent are harder to reach.

One large adjustment factor is for persons who self-reported as having less than a high school education. The factors for the Latino, non-Latino Asian, non-Latino African American and non-Latino Native Hawaiian and Other Pacific Islander groups are also all larger suggesting potential undercoverage.

7.5 Sources Used to Produce the Control Totals for CHIS 2011-2012

Since the beginning of CHIS, considerable thought was given to the choice of data for the primary source of the control totals. It is desirable to use an up-to-date source available at the county or sub-county level and including separate totals for the main age, race, sex, and ethnic groups. During the CHIS 2003 cycle, the California Department of Finance (DOF) Population Projections were selected as the primary source for control totals for CHIS, supplemented by other sources. These files are described in the following sections.

7.5.1 California Department of Finance Population Predictions and Estimates

Based on discussions with UCLA, the 2012 California DOF Population Projections poststratified to 2012 DOF Population Estimates were used as the primary source of control totals for the demographic control totals (i.e., raking dimensions defined by gender, race, ethnicity, age, and stratum) for CHIS 2011-2012 (State of California, Department of Finance, 2013). The population projections are available at the county level by race, ethnicity, gender and single age for each year and projected 50 years into the future. The projections are revised after each decennial census.

The 2012 DOF population projections are provided at the county level by gender, race/ethnicity and single age for each year as indicated in Table 7-5. The DOF population projections used the 2010 Census counts as the baseline. The DOF uses a baseline cohort-component method to project population estimates based on fertility/mortality rates and life expectancy by different race-ethnic groups and age cohorts. Special populations (those in prisons, colleges, and military installations) that have very different demographic and behavioral characteristics from the household population were removed from the baseline and projected separately. However, the DOF files held most of the special populations only for 2010. This factor played an important role in the assumptions made when removing the population living in group quarters from the control totals in CHIS 2011-2012 as described in Section 7.6.1.

Table 7-5. Definition of counts available in the 2012 California DOF population projections files*

Variable	Available counts
Age groups (101)	Age 0 Age 1 . . . Age 100 or more
Sex (2)	Male Female
Race-ethnicity (6)	Latino White alone Latino African American alone Latino American Indian/Alaska Native alone Latino Asian alone Latino Native Hawaiian and Other Pacific Islander alone Latino Two or more races Latino, any race Non-Latino White alone Non-Latino African American alone Non-Latino American Indian/Alaska Native alone Non-Latino Asian alone Non-Latino Native Hawaiian and Other Pacific Islander alone Non-Latino Two or more races

* Available at the county level

Source: State of California, Department of Finance.

The main disadvantage of the DOF projections is the race categorization. The DOF population estimates follow the U.S. Office of Management and Budget (OMB) race definition known as "modified" race with no separate population counts for "other" race. The DOF estimates comply with the OMB 1997 revised standards for collection, tabulation, and presentation of federal data on race and ethnicity (Office of Management and Budget, 1997). The revised OMB standards identify only five main racial categories (White, Black or African American, American Indian and Alaska Native, Asian, and Native Hawaiian and Other Pacific Islander) and combinations of these categories. In CHIS, respondents who could not identify themselves as any of the five OMB race categories could answer with a sixth category, "some other race," consistent with the 2010 Census data collection method. Recoding of "other race" for CHIS 2011-2012 largely followed Census procedures (see *CHIS 2011-2012 Methodology Series: Report 3 - Data Preparation*). In order to use the DOF estimates, any sampled person who reported "other race" (alone or in combination with another race) had to be recoded into the OMB categories. In order to reduce the number of imputations of "other race" respondents, a variable combining ethnicity with OMB race was proposed and approved by UCLA. The creation and imputation of this variable, OMBSRREO, is described in Section 8.4.2

The DOF also provides Population Estimates (State of California, Department of Finance, 2012) for current and previous years. The estimates are updated projections based on current birth and death data. The difference between the DOF projections and estimates is that the former are produced before the projected year and the latter after the estimated year. Therefore, the distributions of the DOF Population Estimates are more representative of the population. The disadvantage is that the population estimates are only available for the total population at the county level.

Both the DOF population projections and estimates include the population living in group quarters. Since the target population in CHIS 2011-2012 excludes persons in group quarters, these persons were removed from the DOF population projections. The Census 2010 files were used to estimate the proportion of persons in group quarters, and these proportions were removed from the DOF estimates.

7.5.2 Census 2010 Files

As in previous cycles of CHIS, the DOF population totals had to be adjusted to remove the population living in group quarters who was not eligible for the survey. The 2010 Census Summary File 1 (U.S. Census Bureau, 2012a) was used to compute the proportion of persons living in group quarters. Section 7.6.1 describes the details of this process

The 2010 Census Summary File 1 (U.S. Census Bureau, 2012a) was used to derive the control totals for the dimension defined by SPAs in Los Angeles and Health Regions in San Diego County (dimension 4 in Table 7-1). The proportions of the total population in those areas were computed from the 2010 Census files. This assumes that the proportion in these areas with respect to the county did not change between 2010 and 2012[13]. The Los Angeles SPAs and San Diego Health Regions were both defined in terms of Census Tracts.

The 2010 Census Summary File 2 (U.S. Census Bureau, 2012b) was used to compute the control totals for Asian ethnic groups in dimension 7. The 2010 Census Modified Race File (U.S. Census Bureau, 2012c) was used to adjust the Census SF1 files to produce totals that include “other race” as a separate race category not found in the DOF files.

7.5.3 American Community Survey for California

The American Community Survey (ACS) is a nationwide survey that provides current and detailed demographic, social, economic, and housing data. It is a critical element in the Census Bureau’s reengineered 2010 Census plan as it has replaced the decennial census long form. The ACS can be used to

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[13] The population in group quarters was removed from these areas and the county before computing the proportions.

produce population and household estimates for a limited number of characteristics at the state level and for over 800 geographical areas.

The 2009-2011 California ACS public use micro data file (PUMS) (U.S. Census Bureau, 2012) was used to compute proportions by educational attainment and type of household (tenure and number of adults in the household) at the region level as these variables were not available in the DOF files. These proportions were applied to the 2012 DOF total population counts to derive the control totals for the raking dimensions defined by these characteristics (dimensions 9, 10, and 11 in Table 7-1). The proportions were calculated at the region level after assigning each Public Use Microdata Areas (PUMAs) to a region in California. Applying the 2011 factors assumed that there were no changes in the population proportions between 2011 and 2012 for these variables.

7.5.4 The National Health Interview Survey

The National Health Interview Survey (NHIS) is one of the major data collection programs of the National Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention (CDC), and has been conducted since 1957. The NHIS is an in-person survey where sampling and interviewing are conducted continuously throughout the year. The survey collects information about household telephone service and whether anyone in the household has a wireless telephone. This survey has been used to track wireless substitution in the US. We used estimates from the Early Release program from for January to June 2012 to compute the percentages of adolescents, children, and adolescents by type of telephone service in the household (i.e., landline only, cell phone only, or both). Because the NHIS does not produce estimates at the state level, we use the estimated for the West region. Table 7-6 shows the percentages that were applied to the DOF totals to derive the control totals for poststratification for telephone use (see Section 4.3).

Table 7-6. NHIS proportions of telephone use by person type

Person type	Telephone service	Proportion
Adults	Landline only	0.102
	Cell phone and landline	0.588
	Cell phone only	0.310
Children and adolescents	Landline only	0.072
	Cell phone and landline	0.558
	Cell phone only	0.370

7.6 Producing the Control Totals for CHIS 2011-2012

As with previous cycles of CHIS, the derivation of the control totals was a challenging task in 2012. It involved the selection of the sources of control totals, determining the number of dimensions, and computing the control totals. It also had an impact on the set of variables to be imputed. In CHIS 2011-2012, there were 12 raking dimensions. Deriving the control totals for each dimension independently could lead to inconsistencies between totals across the dimensions and this would cause problems in the raking process.

To overcome these difficulties, we used the same procedure developed since CHIS 2003 in which the control totals for most of the dimensions were computed simultaneously. In this approach, a file was created with totals for all the possible combinations of the levels from most of the raking dimensions in the source files. These totals were then adjusted to remove the population living in group quarters. In the final step, the file was summarized by aggregating the totals by raking dimension. Because all totals were produced from the same file, there were no inconsistencies (the sum across dimensions was constant and the relationship between dimensions using the same variables such as age was fixed) among the dimensions. The details of this procedure are described in the following sections.

As the first step when computing control totals, the population living in group quarters was removed from the population counts. This is a straightforward process when counts of persons in group quarters for all variables and geographic levels are available. However, this information was not available in the DOF files. By assuming that the proportion of the population in group quarters did not change between 2010 and 2012, the Census 2010 SF1 file could be used to compute these proportions. This assumption is the same one used by the California DOF for its population projections.

In past cycles of CHIS, two problems occurred when computing the percentage of the population living in group quarters using the Census SF1 file. The first was the limited number of group quarter counts that can be produced from the SF1 file. Counts are available by stratum (44) × age group 1 (3) × sex (2) stratum (44) × age group 2 (2) × sex (2) × race (7) stratum (44) × age group 2 (2) × sex (2) × ethnicity (3) as defined in Table 7-6. The Census 2010 files did not include as many detailed group quarters as in the Census 2000 files. For example, the population in group quarters by single age was not available. As a result, the process to remove the population in group quarters was modified based on the limited totals. In the new procedure, it was assumed that the distribution of the population in group quarters is uniform among three age groups (less than 18 years old, 18 to 64 years old, and 65 years old or older). For example, if the percentage of persons 65 or older in group quarters is 1.56 percent, then 1.56 percent of persons 68 years old are assumed to be in group quarters.

The second problem was that the group quarter population counts from the SF1 file are defined for the seven race categories shown in Table 7-7 and not the six OMB race groups used in the DOF file (see Table 7-5). To address this problem, we assumed that the distribution of persons in group quarters by ethnicity (Latino or non-Latino) was also the same within race. For example, if 1.42 percent of the African American population is in group quarters, then 1.42 percent of both Latino African Americans and non-Latino African Americans are assumed to be in group quarters.

Table 7-7. Definition of levels of variables for group quarters populations in the Census 2010 SF1 file

Characteristics	Available counts
Stratum (44)	Counties or combinations of multiple counties defined in CHIS 2011-2012
Age group1 (3)	Less than 18 years old 18 to 64 years old 65 years old or older
Age group2 (2)	Less than 18 years old 65 years old or older
Sex (2)	Male Female
Race (7)	White alone African American alone American Indian/Alaska Native alone Asian alone Native Hawaiian and Other Pacific Islander alone Other race alone Two or more races
Ethnicity(3)	Latino Non-Latino White alone Other

Source: U.S. Census Bureau, Census 2000.

Using these assumptions, we computed the percentage of the population not living in group quarters in 2010. A file with 2010 population totals, T_{rc}^{2000}, was created by summarizing the 2010 SF1 into 22,176 cells denoted *rc*, where *r* denotes race and *c* is the cross-tabulation of stratum (44) × ethnicity (2) × age group (18) × gender (2). The 18 levels of age (see Table 7-8) corresponded to the cross-tabulation of the levels of age available in the DOF data files and in the definition of the raking dimensions. An advantage of summarizing the file by the levels of *c* was the smaller size of the file (i.e., the file contains population totals by the age groups rather than single age). Note that any age group, race, or ethnicity as defined in the raking dimensions could be created by combining the *c* cells.

We defined the cells *rc* as the cross-tabulation of race and the cell *c* as follows:

$$rc = \text{race}_{\overline{OMB}}(7) \times c \,,$$

where the subscript $\overline{OMB}$ refers to the non-OMB race classification that includes a category for "some other race" available in the SF1 file as shown in Table 7-6.

Table 7-8. Age levels corresponding to the cross-tabulation of the DOF data files and the definition of the raking dimensions

Age group (18)	Description
1	0 to 3 years old
2	4 to 5
3	6 to 7
4	8 to 11
5	12 to 14
6	15 to 17
7	18 to 24
8	25
9	26 to 29
10	30
11	31 to 37
12	38 to 39
13	40 to 45
14	46 to 49
15	50 to 53
16	54 to 64
17	65 to 77
18	78 plus

7.6.1 Removing the Population Living in Group Quarters

We now review how the group quarter population was removed from the DOF files. Define $T_{rc}^{2010\,\overline{GQ}}$ as the 2010 population total that excludes the population in group quarters in cell *rc*. The totals $T_{rc}^{2010\,\overline{GQ}}$ were computed by raking the totals T_{rc}^{2010} to three control totals for the population not living in group quarters. Let $D1_m^{2010\,\overline{GQ}}$ be the control total for the first raking dimension computed as

$$D1_m^{2010\,\overline{GQ}} = D1_m^{2010} - D1_m^{2010\,GQ} \,,$$

where $D1_m^{2010}$ is the 2010 total population, $D1_m^{2010\,GQ}$ is the 2010 population total living in group quarters, and *m* is the raking cell defined as $m = \text{strata}(44) \times \text{race}_{\overline{OMB}}(7) \times \text{age group } 1(3) \times \text{sex}(2)$.

In the same way, let $D2_n^{2010\,\overline{GQ}}$ be the control total for the second raking dimension for cell *n* defined as the cross-tabulation of strata(44) × ethnicity(3) × age group 1 (3) × sex(2) as in the SF1. Let $D3_p^{2010\,\overline{GQ}}$ be the control total for the third raking dimension for cell *p*, where *p* is defined as the cross-tabulation of strata(44) × age group 2 (2) as in the SF1.

Note that $D1_m^{2010\,GQ}$, $D2_n^{2010\,GQ}$, and $D3_p^{2010\,GQ}$ are the 2010 population totals living in group quarters available in the SF1 file. By using raking we ensured that all totals, $T_{rc}^{2010\,\overline{GQ}}$, were consistent and they summed to the control totals.

After raking, the proportion of the 2010 population not living in group quarters in cell *rc* was computed as

$$p_{rc}^{2010\,\overline{GQ}} = \frac{T_{rc}^{2010\,\overline{GQ}}}{T_{rc}^{2010}}.$$

Assuming that the proportion of the population not living in group quarters did not change between 2010 and 2012 within cell *rc*, the proportion $p_{rc}^{2010\,\overline{GQ}}$ could be used to compute $T_{rc}^{2012\,\overline{GQ}}$ defined as the 2012 total population not living in group in cell *rc*, as

$$T_{rc}^{2012\,\overline{GQ}} = p_{rc}^{2010\,\overline{GQ}} * T_{rc}^{2012},$$

Where T_{rc}^{2012} is the 2012 total population from the 2012 California DOF file in cell *rc*. However, T_{rc}^{2012} could not be computed using the DOF file due to differences in race categorization between the SF1 and the DOF projection. Instead, the 2012 population estimates, $T_{sc}^{2012\,OMB}$, were available in the DOF file for 19,008 cells (labeled *sc*) defined using the OMB race categories. The cells *sc* were defined by the cross-tabulation of $sc = \text{race}_{OMB}(6) \times c$, where the subscript *OMB* refers to the OMB race groups that exclude the "some other race" category as shown in Table 7-9, and *c* is defined as before.

Table 7-9. OMB race categories available in the California DOF files

$\text{race}_{\text{OMB}}(s)$	Description
1-W	OMB White alone
2-AA	OMB Black or African American alone
3-AI	OMB American Indian or Alaska Native alone
4-AS	OMB Asian alone
5-PI	OMB Pacific Islander Native Hawaiian alone
6-TM	OMB Two or more races

In order to examine the relationship between the totals T_{sc}^{OMB} and T_{rc}, consider the following summation:

$$T_c^{OMB} = \sum_s T_{sc}^{OMB} = T_{Wc}^{OMB} + T_{AAc}^{OMB} + T_{AIc}^{OMB} + T_{ASc}^{OMB} + T_{PIc}^{OMB} + T_{TMc}^{OMB} .$$

In the same way, the total population in a cell *c* can be represented by non-OMB race groups as

$$T_c = \sum_r T_{rc} = T_{Wc} + T_{AAc} + T_{AIc} + T_{ASc} + T_{PIc} + T_{Oc} + T_{TMc} .$$

The assignment of OMB race was done within cell *c*; in other words, the total population in the cell *c* stays constant. That is

$$T_c = \sum_r T_{ri} = T_c^{OMB} = \sum_s T_{sc}^{OMB} .$$

When assigning an OMB race value, persons who reported “some other race” alone were assigned one of the OMB race categories. Persons who reported two races, one being “other race,” kept the OMB race category but dropped “other race.” In other words, they were assigned a single OMB race. Persons who reported more than two races, one of these being “other race,” were still considered as having multiple races (the “other race” removed).

In order to illustrate the reallocation, consider the Asian group (ignoring the stratum, age group, sex, and ethnicity components of the cell),

$$T_{ASc}^{OMB} = T_{ASc} + p_{AS\_O}^{OMB} * T_{Oc} + p_{AS\_TM}^{OMB} * T_{TMc} ,$$

where

T_{ASc}^{OMB} is the total number of Asians (OMB definition);

T_{ASc} is the total number of Asians (non-OMB definition);

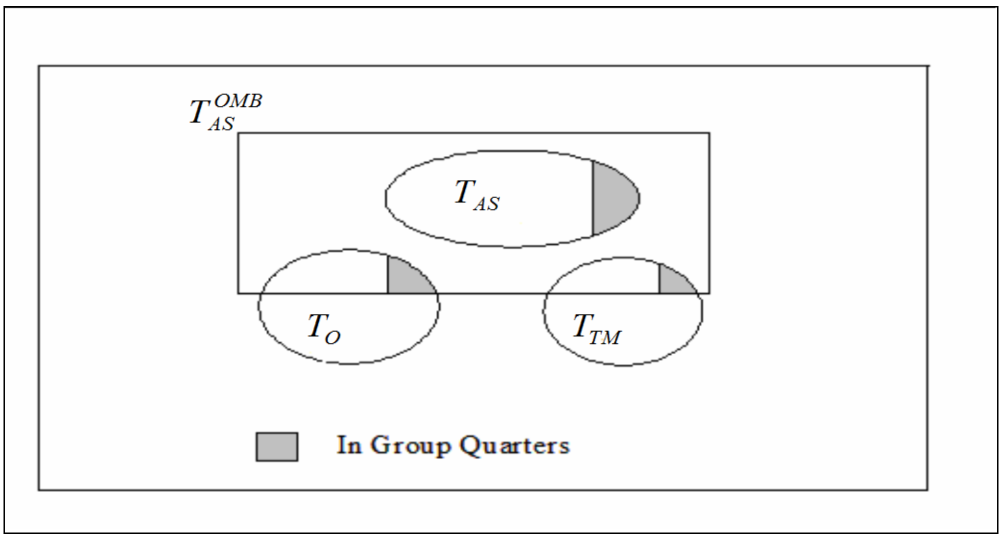
T_{TMc} is the total number of persons with two or more races (non-OMB definition);

$p_{AS\_O}^{OMB}$ is the proportion of persons with some other race alone who were coded as Asian alone when assigning the OMB definition; and

$p_{AS\_TM}^{OMB}$ is the proportion of persons with two or more races who are coded as Asian alone when assigning the OMB definition.

In other words, the OMB Asian alone population (T_{ASc}^{OMB}) is composed of the original non-OMB Asian-alone total (T_{ASc}), the portion of the population who reported "some other race" alone that is allocated to OMB Asian ($p_{AS\_O}^{OMB} * T_{Oc}$), and the population who reported non-OMB Asian-alone and "some other race." Figure 7-1 visualizes how the OMB Asian-alone population is formed, where T_{AS}^{OMB}, T_{AS}, and T_{TM} are defined above and T_O is defined as the group who reported "other race" only (omitting the subscript *c* for convenience).

Figure 7-1. Relationship between OMB Asian alone and non-OMB groups



In this example, the proportion of the population in group quarters was known for the non-OMB Asian alone group. In order to compute the proportion of the population not in group quarters for OMB Asian alone we assumed the same proportion holds for the members that were being reclassified into the OMB race group. That is,

$$\frac{T_{AS}^{OMB\,\overline{GQ}}}{T_{AS}^{OMB}} \approx \frac{T_{AS}^{\overline{GQ}}}{T_{AS}} = \frac{T_{AS}^{\overline{GQ}} + T_{O}^{\overline{GQ}} + T_{TM}^{\overline{GQ}}}{T_{AS} + T_O + T_{TM}},$$

only for $O \in AS$ and $TM \in AS$, (i.e., OMB race assignment to *AS*).

Generalizing these results to the other groups, the proportion of the population not in group quarters, $p_{rc}^{\overline{GQ}}$, can be computed as

$$p_{rc}^{\overline{GQ}} = \frac{T_{rc}^{\overline{GQ}}}{T_{rc}} \approx \frac{T_{sc}^{OMB\,\overline{GQ}}}{T_{sc}^{OMB}} = p_{sc}^{\overline{GQ}}$$

Under the assumption that the proportion of the population not living in group quarters did not change between 2010 and 2012 the proportion was computed as

$$p_{sc}^{2012\,\overline{GQ}} = p_{sc}^{2010\,\overline{GQ}} = \frac{T_{rc}^{2010\,\overline{GQ}}}{T_{rc}^{2010}}.$$

The proportion $p_{sc}^{2012\,\overline{GQ}}$ was used to compute the 2012 total population not living in group quarters in cell *sc*, $T_{sc}^{2012\,OMB\,\overline{GQ}}$, defined using the OMB race categories, as follows:

$$T_{sc}^{20012\,OMB\,\overline{GQ}} = p_{sc}^{2012\,\overline{GQ}} * T_{sc}^{2012\,OMB} = \frac{T_{rc}^{2010\,\overline{GQ}} * T_{sc}^{2012\,OMB}}{T_{rc}^{2010}}.$$

where T_{rc}^{2010} is computed using the SF1 file, $T_{sc}^{2012\,OMB}$ using the 2012 DOF file and $T_{rc}^{2010\,\overline{GQ}}$ is the 2010 population in cell *rc* not in group quarters, as defined earlier. The 2012 total population not living in group quarters in California is computed as

$$T^{2012\,\overline{GQ}} = \sum_{s}\sum_{c} T_{sc}^{2012\,OMB\,\overline{GQ}}.$$

Table 7-10 shows the total population in the 2012 DOF file and the estimated total (and percentage) of the population living in group quarters.

Table 7-10. Population in California in 2012 by group quarter status

Type	Population	%
In group quarters	895,137	2.37
Not in group quarters	36,931,023	97.63
Total	37,826,160	100.00

7.6.2 Computing the Control Totals

The totals $T_{sc}^{2012\,OMB\,\overline{GQ}}$ were summarized in order to compute the control totals for dimensions 1, 2, 3, 5, 6, and 8. For dimension 7, defined for Asian ethnic groups, the control totals were derived using the same demographic totals but for using the Asian only total and the Census 2010 SF2 file. The percentages of the Asian groups by ethnicity (Latino, non-Latino) were computed using the 2010 SF2 file. It was assumed that there were no changes in the distribution of the Asian groups between 2010 and 2012. These percentages were applied to the 2012 DOF projections.

The creation of dimension 4, defined by SPAs in Los Angeles County and Health and Human Services Agency (HHSA) Service Regions in San Diego County, used information from the Census 2010 SF1. The Los Angeles County Department of Health (LACDH) produced a listing of Census tracts by SPA. The 2010 SF1 file was used to compute the percentages of the population in the SPAs by aggregating population counts in the Census tracts. This percentage was applied to the total 2012 DOF population total (excluding group quarters) to produce the controls for dimension 4. A similar procedure was used for San Diego County Health Regions.

For dimensions 9 (adult's education attainment), 10 (number of adults in the household), and 11 (nontelephone adjustment), the percentages of the population were computed using the 2009-2011 ACS-PUMS and then applied to the 2012 DOF population total (excluding group quarters). The underlying assumption was that there were no changes in the distribution of the population between the 2009-2011 ACS and 2012.

8. IMPUTATION PROCEDURES

In any household survey, both unit and item nonresponse are virtually unavoidable. We have described how weighting adjustments have been used to compensate for unit nonresponse in CHIS 2011-2012. *CHIS 2011-2012 Methodology Series: Report 4 – Response Rates* discusses unit nonresponse in detail. This chapter focuses on item nonresponse and the imputation for missing responses of the variables used in weighting. The imputed values were needed in the last stages of the weighting process, and only interviews that were considered completed units were subject to imputation. The percentage of missing data and consequent imputation for virtually all of these items is small.

Section 8.1 describes the imputed variables and reviews the different types of imputation techniques used to fill in the missing data. The two imputation techniques employed in CHIS 2011-2012 are random allocation and hot-deck imputation. Sections 8.2 through 8.4 discuss the imputation process for all imputed variables separately. The last section lists the geographic location variables for CHIS 2011-2012. We derived these variables after geocoding the geographic information either collected during the interview (address of respondent, nearest street intersection, self-reported county) or attached to the sample telephone (address for numbers that were mailable or ZIP Code covered by the telephone exchange).

8.1 Imputed Variables and Methods

Table 8-1 lists the variables imputed for weighting in CHIS 2011-2012. The same set of variables was imputed in CHIS 2009. As noted above, the level of missing data is relatively small. The specific percentages of missing data are given later in the chapter. When the amount of missing data is small and assuming that the data are missing at random (i.e., the missing data have the same distribution as those with complete data within groups defined for imputation), then the bias of estimates due to missing data should be relatively small. The imputations may also increase the variance of the estimates, but this effect should be negligible given the low rate of missing data. A flag indicating if the response is imputed accompanies every value.

Table 8-1. Description of imputed variables

Variable name	Description	Interview items	Variable type
SRAGE	Self-reported age	AA2, CA3, TA2, KAA2	Demographic
SRSEX	Self-reported sex	AA3, CA1, TA3, KAA3	Demographic
SRTENR	Self-reported household tenure	AK25, KAK25	Socio-economic
SREDUC	Self-reported educational attainment	AH47, KAK47	Socio-economic
SRH	Self-reported Latino	AA4, CH1, TI1	Ethnicity
SRW	Self-reported white	AA5A_6, CH3_6, TI2_6	Race
SRAA	Self-reported African American	AA5A_5, CH3_5, TI2_5	Race
SRAS	Self-reported Asian	AA5A_4, CH3_4, TI2_4	Race
SRAI	Self-reported American Indian/ Alaska Native	AA5A_3, CH3_3, TI2_3	Race
SRPI	Self-reported Native Hawaiian and Other Pacific Islander	AA5A_1, AA5A_2, CH3_1, CH3_2, TI2_1, TI2_2	Race
SRO	Self-reported Other race	AA5A_7, CH3_7, TI2_7	Race
OMBSRREO	OMB self-reported race/ethnicity		Race/ Ethnicity
OMBSRASO	OMB self-reported non-Latino Asian group	AA5E_1- AA5E_18, TI7_1- TI 7_18, CH7_1-CH7_18	Race/ Ethnicity
HASCELL	Cell/Wireless telephone service in household	AM33, KAM33	Telephone service
HASLANDLINE	Landline telephone service in household	AN6, AN7	Telephone service

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

In CHIS 2011-2012 and previous cycles, random allocation and hot-deck imputation were used to fill in the missing responses. The first imputation technique is a random selection from the observed distribution. This method is used only when the item missing rate is very small.

The second technique, hot-deck imputation, was used to impute race and ethnicity (including the OMB race-ethnicity variables) as well as household tenure and educational attainment in the previous cycles of CHIS. The hot-deck approach is probably the most commonly used method for assigning values for missing responses in large-scale household surveys (Sande, 1983; Ford, 1983). With a hot deck, a value reported by a respondent for a particular item is assigned or donated to a “similar” person who did not respond to that item. In order to carry out hot-deck imputation for CHIS 2011-2012, the respondents to an item form a pool of donors while the nonrespondents are a group of recipients. A recipient is matched to the subset pool of donors with the same characteristics. The recipient is then assigned a randomly imputed value from one of the donors in the pool. Once a donor is used, it is removed from the donor pool.

8.2 Self-Reported Sex and Age

The percentage of cases where either sex or age was missing in CHIS 2011-2012 is very small across all samples (landline, surname list, cell phone, and area) and types of extended interviews (adult, child, and adolescent). Table 8-2 summarizes the number of cases that were imputed for sex and age. The sex of three children and one adult were missing and were imputed randomly for these 4 cases.

Age was imputed in 105 cases in CHIS 2011-2012 across all samples. A hierarchical process was followed to impute the missing self-reported age values for adults in the landline and list samples. The process used the values for self-reported age (question AA2 on the adult interview), the self-reported adult age range (question AA2A on the adult interview) asked when the adult refused to provide a specific age, the proxy-reported adult age collected during the child-first interview (question KAA2) if available, and the adult age collected during the screener interview (question ADULTAGE on the screener interview).

Table 8-2. Number and percentage of completed interviews with missing self-reported sex and age by sample type

Sample Person type	Number completed	Number missing sex	% missing sex	Number missing age	% missing age
Landline/Lists					
Adult	33,784	1	0.00	89	0.26
Child	5,811	3	0.05	7	0.12
Adolescent	2,242	0	0.00	1	0.04
Total	41,837	4	0.01	97	0.23
Cell Phone	9,151	0	0.00	8	0.09
Adult	1,523	0	0.00	0	0.00
Child	557	0	0.00	0	0.00
Adolescent	11,231	0	0.00	8	0.07
Overall Total	53,068	4	0.01	105	0.20

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The missing age for adults was imputed as follows. First, if an adult had a missing self-reported age, we checked whether the adult age was collected from a proxy adult in the child-first interview. If age was reported, this age was assigned to the sampled adult. If an age was not reported in the child-first interview, the screener age for the sampled adult was checked. If the screener age was within an age range given by the sampled adult, then screener age was used as the imputed age. If the age range was not reported, then the screener age was used. However, if the screener age was outside the reported age range, then age was randomly selected using the distribution of self-reported age within the reported age range. If no age was collected during the screener but an age range was reported, then age was randomly imputed from the distribution of self-reported age within the reported age range. If no information on age was available from any source, then age was randomly imputed using the distribution of self-reported age of all adult respondents. As an example, assume an adult respondent did not report an age but reported an age range of 40 to 44. Assume also that the proxy reported adult age in the child-first interview was 38 and the age collected in the screener interview when the adult was sampled was 38. This situation could result if the proxy misreported the sampled adult age in both the screening interview and the child-first interview. For this case, the adult age would be imputed using the distribution of the self-reported age of adults age 40 to 44. Assume that the distribution of adult age is such that 41 percent of sampled adults were age 41 or less and 62 percent were age 42 or less. If the random number assigned to the adult had a value of 0.44 then the adult's imputed age would be 42 years old.

8.3 Household Tenure and Educational Attainment

Household tenure and the adult respondent's educational attainment were used to create raking dimensions 9 and 11. Household tenure had 416 missing responses (0.93 percent), and educational attainment had 237 missing responses (0.55 percent).

Hot-deck imputation was used to impute missing values for these two variables. The search algorithm CHAID (Kass, 1980) was used to create the hot-deck cells using the variables available for both donors and recipients found to be good predictors. A donor was then randomly drawn from the cell and its value for the variable being imputed was assigned to the recipient. Table 8-3 shows the variables considered in CHAID to create the hot-deck cells for educational attainment and household tenure. Table 8-4 shows the distribution of the imputed cases by sample type. When calculating the percentages, the denominator for educational attainment is the number of adults in a given education category, and for tenure the denominator is all adults who own or rent.

Table 8-3. Variables used to define hot-deck cells for the imputation of education attainment and household tenure

Variable Name	Description
Educational Attainment	
SRSEX	Self-reported sex
SRRACE_O	Self-reported race
SRH	Self-reported ethnicity
SRAGE	Self-reported age
ADLTFLG	Number of adults in the household
CHLDFLG	Children present in the household
TEENFLG	Adolescents present in the household
POVERTY	Poverty
P_GRAD	Percent college graduates in exchange
P_OWN	Percent home owners in the exchange
P_BLACK	Percent African Americans in the exchange
P_HISP	Percent Latinos in the exchange
CREGION	California Regions
Household Tenure	
ADLTFLG	Number of adults in the household
CHLDFLG	Children present in the household
TEENFLG	Teens present in the household
P_GRAD	Percent college graduates in exchange
P_BLACK	Percent African Americans in the exchange
P_HISP	Percent Latinos in the exchange
P_OWN	Percent home owners in the exchange
POVERTY	Poverty
CREGION	California Regions

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Table 8-4. Counts and percentages of imputed self-reported education attainment and household tenure

	Adult interviews			
	Sample type			
	Landline/list		Cell phone	
	Count	Percentage	Count	Percentage
Self-reported Education Attainment				
Under 18 years of age	NA		NA	
Less than HS, 18 years of age or older	48	1.16	7	0.70
High School (or equivalent), 18 years of age or older	58	0.78	14	0.62
Some college, 18 years of age or older	41	0.45	9	0.36
BS and above, 18 years of age or older	53	0.41	7	0.21
Total	200	0.59	37	0.40
Self-reported Household Tenure				
Owner	161	0.69	37	0.80
Renter	117	1.10	41	0.91
Total	278	0.82	78	0.85

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

8.4 Self-Reported Race and Ethnicity

As described in Chapter 7, the person weights were raked to control totals from the 2012 California DOF Population Estimates. The California DOF complies with the OMB 1997 revised standards for collection, tabulation, and presentation of federal data on race and ethnicity. The revised OMB standards identify only five main racial categories and combinations of these categories. The main categories are White, Black or African American, American Indian and Alaska Native, Asian, and Native Hawaiian and Other Pacific Islander. Census 2010 allowed a sixth race category ("some other race") for respondents who could not identify with any of the five OMB race categories. Because all public release files of the Census 2010 include six race categories, the Census Bureau released a special file called Modified Race Data Summary file (MRDSF) with 2010 population counts by the five OMB race categories (U.S. Census Bureau, 2012). To produce this file the Census Bureau implemented special procedures to assign and impute an OMB race to those who reported "some other race." The California DOF Estimates used the 2010 MRDSF as the baseline for the time series; as a result, the DOF Estimates include only counts by the five OMB racial categories by county.

Following a procedure similar to the Census 2010, respondents who could not identify themselves as any of the five OMB race categories could answer "some other race" in CHIS. In order to use the DOF estimates as control totals, any sampled person who reported "some other race" (alone or in combination) had to be recoded into one or more of the OMB categories. OMB race was missing 6,314 persons (11.9 percent) in CHIS 2011-2012. After examining the procedures used by the Census to assign an OMB race, we determined that the assignment of OMB race could not be implemented using the available variables in CHIS 2011-2012 as in Census 2010, because the number of CHIS cases in the geographic area (i.e., stratum) by Latino origin[14] cells is not large enough to guarantee a good assignment. The same situation occurred in previous cycles. To reduce the number of records to be imputed, a combined race/ethnic variable (OMBSRREO) that assigned Latinos regardless of race into one group was proposed and approved. The levels of the variable OMBSRREO are given in Table 8-5.

Table 8-5. OMB race/ethnicity groups (OMBSRREO)

OMBSRREO	Description
1	Latino
2	Non-Latino White
3	Non-Latino African American
4	Non-Latino American Indian Alaskan Native
5	Non-Latino Asian
6	Non-Latino Pacific Islander Native Hawaiian
7	Non-Latino two or more races

By creating a separate group for Latinos, a valid value of OMBSRREO was missing for only 102 persons (0.19 percent) who self-reported as non-Latino and "some other race" alone[15] in 2011-2012. The reduction in the number of cases is because most of the people who report other race were Latino. Using a variable that combined race-ethnic groups with one level of OMBSRREO for Latino eliminated the need to impute for 6,212 cases who reported Latino "other race" alone.

For continuity with the race and ethnicity variables created since 2001 (see Table 8-1), the same variables were created and imputed in 2011-2012. We refer to these variables as the "regular" single race and ethnicity variables. The OMB race-ethnicity variable OMBSRREO was created using these regular race and ethnicity variables after imputation. Section 8.4.1 describes the imputation of the regular race and ethnicity variables while Section 8.4.2 describes the creation and imputation of the OMB race variable. Section 8.4.3 discusses the creation and imputation of self-reported Asian ethnic groups.

[14] Donors and donees must match on the specific Latino origin (Not Hispanic; Mexican; Puerto Rican, Cuban, Central American and Dominican; South American; Other Spanish).

[15] This includes records imputed as non-Latino "other" from the regular CHIS 2011-2012 race imputation.

8.4.1 Imputation of Single Self-Reported Race and Ethnicity

While the procedures used to impute for missing values of sex and age were relatively straightforward, self-reported race and ethnicity presented a greater challenge. Different imputation methods were considered before choosing the final approach. One approach that was considered, but not adopted, was to use the self-reported race and ethnicity of a respondent to impute for any other sampled person with missing values for these items within the household. The reason this approach was not used in any cycle of CHIS is the realization that the method does not account for households with persons of more than one race and ethnicity.

Instead, a hot-deck imputation procedure was developed to deal with the diversity of race and ethnicity within households. Before describing the hot-deck approach, some special features of the race and ethnicity items are worth noting. First, although race is a series of items with subparts, the items we deal with are only those that classify a person as White, African American, Asian, American Indian/Alaska Native, Pacific Islander, or other. Also, these items are treated as either all reported or all missing. In very few cases there were missing values for one of the races but not others, but the data preparation staff was able to replace these missing values using interviewer comments. Finally, some missing values were assigned deterministically based on other items such as country of origin. These deterministic imputations were flagged like all other imputations.

Table 8-6 shows the number and percentage of cases with imputed values by type of extended interview (adult, child, and adolescent). The first columns are those cases where race is imputed, and the next set of columns is for cases where ethnicity is imputed.

Table 8-6. Number and percentage of imputed interviews with missing self-reported race and/or ethnicity

Sample type	Imputed race*		Imputed ethnicity	
Type of interview	Count	%	Count	%
Landline/list	1,969	4.7	163	0.39
Adult	1,305	3.9	124	0.37
Child	408	7.0	28	0.48
Adolescent	256	11.4	11	0.49

Table 8-6. Number and percentage of imputed interviews with missing self-reported race and/or ethnicity (continued)

Sample type Type of interview	Imputed race* Count	%	Imputed ethnicity Count	%
Cell phone	562	5.0	33	0.29
Adult	410	4.5	22	0.24
Child	96	6.3	7	0.46
Adolescent	56	10.1	4	0.72
Total	2,531	4.8	196	0.37

* At least one value of race was imputed.

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The hot-deck imputations were done separately by the completed extended interview structure of the household. In general, the imputation procedure was done at the household level and handled households with the fewest missing values first and then moved to the cases with more missing values. The simplest household structure is where only an adult was interviewed (versus a household with an adult and an adolescent and/or a child). A household with only one adult with missing ethnicity was imputed before a household with only an adult that had both missing race and ethnicity.

The patterns of missing data for race and ethnicity varied by structure of the household. For the simple case where only an adult was interviewed, the donors were selected from other adult-only households. If the adult was missing both race and ethnicity, both values were imputed from the same donor. If the adult had a reported race but was missing ethnicity, then a donor with the same race (all six race values were placed into a vector and only adults with the exact same values could be donors) was randomly selected. For an adult with reported ethnicity and missing race, the same procedure was used; only adults in adult-only households with the same value of ethnicity could be donors. Whenever possible, the donors and the recipients were from the same sampling stratum. For cases where the pool formed in this way had too few donors, sampling strata were combined based on geographic and urban status. Once a donor was used, it was removed from the pool for all future hot deck runs.

The same principles were used for more complex household structures. In these cases, some households had missing race and ethnicity for all sampled persons, while in others one or more of the sampled persons might have a reported race and ethnicity. Various combinations, such as a reported ethnicity but not race, were also encountered. Separate hot deck runs were made to accommodate all of these situations. As an illustration, consider households where an adult and a child are interviewed. Assume the adult reported non-Latino ethnicity and Asian race and the child only reported non-Latino ethnicity but no race. The pool of donors for imputing the child's race consists of households where only an adult and a child were interviewed and where the adult reported non-Latino ethnicity and Asian race and the child reported non-Latino ethnicity. The households with other combinations of persons with missing race and/or ethnicity were imputed in a similar way. Table 8-7 shows the counts and percentages of imputed values by self-reported race and ethnicity and type of extended interview (adult, child, and adolescent).

Table 8-7. Counts and percentages of imputed interviews with missing self-reported race and ethnicity by type of extended interview

			Extended interview type					
	Total		Adult		Child		Adolescent	
	Count	%	Count	%	Count	%	Count	%
Self-reported race								
White alone	1,243	2.34	865	2.01	259	3.53	119	4.25
African American alone	42	0.08	27	0.06	9	0.12	6	0.21
Asian alone	65	0.12	46	0.11	11	0.15	8	0.29
American Indian/ Alaska Native alone	49	0.09	39	0.09	6	0.08	4	0.14
Pacific Islander alone	2	0.00	1	0.00	0	0.00	1	0.04
Other race alone	1,089	2.05	716	1.67	204	2.78	169	6.04
Two or more races	41	0.08	21	0.05	15	0.20	5	0.18
Total	2,531	4.77	1,715	3.99	504	6.87	312	11.15
Self-reported Ethnicity								
Latino	51	0.10	28	0.07	18	0.25	5	0.00
Non-Latino	145	0.27	118	0.27	17	0.23	10	0.00
Total	196	0.37	146	0.34	35	0.48	15	0.01
Completed interviews	53,068	100.00	42,935	100.00	7,334	100.00	2,799	100.00

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

8.4.2 Imputation of the OMB Race-Ethnicity Variable

The DOF control totals are defined in terms of OMB race categories for raking dimensions 5, 6, and 8. Persons who reported themselves as Latino “some other race” were assigned an OMB race following procedures similar to those used in Census 2010. Since the OMB assignment is done using the imputed regular single-race variables, all sampled persons have nonmissing race values for variables SRW, SRAA, SRAI, SRAS, SRPI, and SRO.

The OMB race-ethnicity variable, OMBSRREO, was assigned as follows:

- If the person self-reported as Latino (SRH=1), the variable OMBSRREO was set to 1. This assignment is independent of the values of the race variables.

- If the person self-reported as non-Latino (SRH=2) and reported OMB race alone or in combination with one or more OMB races (e.g., White alone, White and Black or African American, White and Black or African American and American Indian and Alaska Native) then OMBSRREO was given the value 2, 3, 4, 5, 6 or 7 (see Table 8-5) depending on the values of SRW, SRAA, SRAI, SRAS, and SRPI. In other words, there is no modification of race for non-Latinos who reported a valid OMB race(s).

- If the person self-reported as non-Latino (SRH=2) and reported both an OMB race and "some other race" (SRO=1), then OMBSRREO was assigned using only the specified OMB race(s). For example, non-Latino White and some other race became non-Latino White alone. This scenario is an example of the differences between OMBSRREO and the regular race-ethnicity variables (SRH, SRW, SRAA, SRAI, SRAS, and SRPI). Persons who reported two races, with one of them "some other race" are considered as single race respondents based on the OMB definition.

After the race/ethnicity assignments were made, 86 persons (0.16 percent) remained with missing values of OMBSRREO. These persons self-reported as non-Latino and other race only (SRH=2 and SRO=1). The missing values were imputed using the same procedures used to impute the regular single race variables as described above. In this case, temporary OMB race variables named SRW2, SRAA2, SRAI2, SRAS2, and SRPI2 were created using the values of already imputed SRW, SRAA, SRAI, SRAS, and SRPI. The values of the temporary OMB race variables were set to missing for the cases where the person self-reported as non-Latino and other race only. The missing values were imputed through a series of hot-deck imputations where pools of donors were created by matching the structure of the household and non-missing values of race and ethnicity of the adult, child, or adolescent in the household within geographic areas (i.e., stratum, region, or urban/rural area). For cases where there was no pool of donors based on household structure, missing values were imputed using the value of SRW2, SRAA2, SRAI2, SRAS2, and SRPI2 from another member of the household. Next, the variable OMBSRREO was assigned for the records with SRH=2 and SRO=1 using the imputed of values SRW2, SRAA2, SRAI2, SRAS2, and SRPI2. Table 8-8 shows the counts and percentages of imputed OMBSRREO values by type of extended interview (adult, child, and adolescent).

Table 8-8. Number and percentage of completed interviews with missing OMB race and ethnicity by extended interview type

OMB Race-ethnicity (OMBSRREO)	Total		Extended interview type: Adult		Child		Adolescent	
	Imputed Count	%	Imputed Count	%	Imputed Count	%	Imputed Count	%
1. Latino	0	0.00	0	0.00	0	0.00	0	0.00
2. Non-Latino White alone	73	0.14	69	0.16	2	0.03	2	0.07
3. Non-Latino African American alone	7	0.01	7	0.02	0	0.00	0	0.00
4. Non-Latino Asian alone	1	0.00	1	0.00	0	0.00	0	0.00

Table 8-8. Number and percentage of completed interviews with missing OMB race and ethnicity by extended interview type (continued)

	Total		Extended interview type					
			Adult		Child		Adolescent	
OMB Race-ethnicity (OMBSRREO)	Imputed Count	%	Imputed Count	%	Imputed Count	%	Imputed Count	%
5. Non-Latino American Indian/ Alaska Native alone	4	0.01	4	0.01	0	0.00	0	0.00
6. Non-Latino Native Hawaiian and Other Pacific Islander alone	0	0.00	0	0.00	0	0.00	0	0.00
7. Non-Latino two or more races	1	0.00	1	0.00	0	0.00	0	0.00
Total	86	0.16	82	0.19	2	0.03	2	0.07
Completed interviews	53,068	100.00	42,935	100.00	7,334	100.00	2,799	100.00

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

8.4.3 Self-Reported Asian Ethnic Group

The person weights were raked using a dimension defined for Asian groups (Dimension 7). Since there was only one weight for the combined landline and supplemental list samples in CHIS 2011-2012, we added a variable (OMBSRASO) for a raking dimension that would improve the estimates of the largest Asian ethnic groups in California. The variable OMBSRASO identifies the OMB non-Latino Asian ethnic group and is defined in Table 8-9.

Table 8-9. OMB Non-Latino Asian ethnic groups (OMBSRASO)

OMBSRASO	Description
1	Non-Latino Chinese alone
2	Non-Latino Korean alone
3	Non-Latino Filipino alone
4	Non-Latino Vietnamese alone
5	Other

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The process to derive the variable OMBSRASO used the temporary OMB race variable SRAS2 previously created for the imputation of OMBSRREO. For records where SRAS2=1 (self-reported as OMB Asian alone or combined with some other race), five flags indicating the Asian ethnic groups of the respondent were derived using the Asian ethnic group questions in the extended interview (questions AA5E_1 to AA5E_18 for adults, TI7_1 to TI 7_18 for adolescents, and CH7_1 to CH7_18 for children). The name and description of the Asian ethnic group flags are shown in Table 8-10.

Table 8-10. OMB Asian group flags

Variable	Description
SRCH	Self-reported Chinese
SRPH	Self-reported Filipino
SRKR	Self-reported Korean
SRVT	Self-reported Vietnamese
SRASO	Self-reported Other Asian ethnic group

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The missing values of the OMB Asian group variables (SRCH, SRPH, SRKR, SRVT, and SRASO) were imputed in the same way as the OMB race variables (or the temporary OMB race variables). A series of hot-deck imputations were run where pools of donors were created by matching the structure of the household and non-missing values of race, ethnicity, and Asian ethnic group of the adult, child, or adolescent in the household within geographic areas (i.e., stratum, region, or urban/rural area). For cases where there was no pool of donors based on household structure, race, ethnicity and Asian ethnic group, missing values were imputed using the values of SRCH, SRPH, SRKR, SRVT, and SRASO from another member of the household. The variable OMBSRASO was then created using the variables SRH, SRAA2, SRAI2, SRAS2, SRPI2, and the variables SRCH, SRPH, SRKR, SRVT, and SRASO after imputation. Table 8-11 shows the counts and percentages of imputed OMBSRASO values by type of extended interview (adult, child, and adolescent).

Table 8-11. Number and percentage of completed interviews with imputed OMB Asian ethnic group by extended interview type

			Extended interview type					
	Total		Adult		Child		Adolescent	
OMB Asian group (OMBSRASO)	Imputed count	%	Imputed count	%	Imputed count	%	Imputed count	%
1. Non-Latino Chinese	11	0.02	7	0.02	3	0.04	1	0.04
2. Non-Latino Korean	3	0.01	3	0.01	0	0.00	0	0.00
3. Non-Latino Filipino	4	0.01	4	0.01	0	0.00	0	0.00
4. Non-Latino Vietnamese	4	0.01	4	0.01	0	0.00	0	0.00
5. Other	2,509	4.73	1,697	3.95	501	6.83	311	11.11
Total	2,531	4.77	1,715	3.99	504	6.87	312	11.15
Completed interviews	53,068	100.00	42,935	100.00	7,334	100.00	2,799	100.00

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

8.4.4 Telephone Service

In CHIS 2011-2012, weights were poststratified to totals for telephone service (i.e., landline only, dual users, cell only). Information about the presence of a cell phone for respondents in the line sample was collected through questions AM33 and KAM33 (Respondent has a working cell phone). Similarly, information about the presence of a landline in the cellphone sample is collected through questions AN6 (landline phone in household) and AN7 (landline phone personal or business use). These items are used to create the variables HASCELL and HASLANDLINE which then are used to create the poststratification cells for the telephone use adjustment (see Section 4.3). These variables were imputed at the household level and all competed interviews within the household shared the same values. Hot-deck imputation was used to impute missing values for these two variables. Similarly to the imputation of household tenure, the search algorithm CHAID was used to create the hot-deck cells using the variables available for both donors and recipients found to be good predictors. A donor was then randomly drawn from the cell and its value for the variable being imputed was assigned to the recipient. The same variables used to impute for household tenure listed in Table 8-3 were used to impute the variables related to telephone service. Table 8-12 shows the distribution of the imputed cases by sample type.

Table 8-12. Counts and percentages of imputed telephone type

			Sample type			
	Total		Landline/list		Cell phone	
	Count	Percentage	Count	Percentage	Count	Percentage
Has landline						
Yes	312	0.70	259	0.73	53	0.58
No	22	0.05	0	0.00	22	0.24
Total	334	0.75	259	0.73	75	0.82
Has cell phone						
Yes	288	0.65	213	0.60	75	0.17
No	46	0.10	46	0.13	0	0.00
Total	334	0.75	259	0.73	75	0.17
Completed households	44,559	100.00	35,369	100.00	9,190	100.00

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

8.4.5 Self-Reported County and Self-Reported Stratum

In CHIS 2011-2012, the geographic location variables such as self-reported county of residence, Los Angeles SPA, San Diego County Health Region, Census tract, and self-reported stratum were assigned after geocoding the geographic information collected during the interview (address of respondent, nearest street intersection, or self-reported

In CHIS 2011-2012, the geographic location variables such as self-reported county of residence, Los Angeles SPA, San Diego County Health Region, Census tract, and self-reported stratum were assigned after geocoding the geographic information collected during the interview (address of respondent, nearest street intersection, or self-reported county) or attached to the sample telephone number (the mailing address or ZIP Code covered by the telephone exchange). Table 8-13 shows the variables used in the geocoding process.

Table 8-13. Variables used in geocoding

Variable	Description	Source
AH42	County of residence (self-reported)	Adult questionnaire
AO1ADDR	Confirmed/corrected street address	Adult questionnaire
AO1CITY	Confirmed/corrected city	Adult questionnaire
AO1ZIP	Confirmed/corrected ZIP Code	Adult questionnaire
AM7	ZIP Code (self-reported)	Adult questionnaire
AO2ADDR	Street address (self-reported)	Adult questionnaire
AO2CITY	City (self-reported)	Adult questionnaire
AM8	Street name of residence (self-reported)	Adult questionnaire
AM9	Street name of nearest cross street (self-reported)	Adult questionnaire
M_ADDR	Street address (matched to phone number prior to interview)	Address mailing vendor
M_CITY	City (matched to phone number prior to interview)	Address mailing vendor
M_ZIP	ZIP Code (matched to phone number prior to interview)	Address mailing vendor
S_ZIP	ZIP Code (provided by sample vendor for every phone)	Sample vendor

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

The derived location variables SRSTRATA (self-reported stratum), SRCOUNTY (self-reported county), SR_LASPA (self-reported Los Angeles SPA), SR_HR (self-reported San Diego County Health Region) are household-level variables that were assigned to all adult, child and adolescent records within the same household before creating the raking dimensions. The variable SRSTRATA was used to create the cells for raking dimensions 1, 2, and 8 defined at the stratum or California region level while the variables SRCOUNTY (self-reported county), SR_LASPA (self-reported Los Angeles SPA), and SR_HR (self-reported San Diego County Health Region) were used to create the cells for raking dimension 4 defined for Los Angeles County and San Diego County.

Table 8-14 shows the distribution of adult respondents by self-reported stratum compared with the sampling stratum for the landline/surname sample. Each stratum had migration in and migration out as a result of self-reports not matching the sampling stratum. This table shows that the net effect of cross-stratum migration is small, with the greatest differences for strata with the lowest geographic counts, as indicated by the net agreement ratios (NAR) in the rightmost column of Table 8-14. The NAR is the number of respondents in the sampling stratum divided by the number of respondents in the self-reported stratum. A NAR value less than one indicates more in-migration than out-migration from the stratum, and a value greater than one the reverse. Most values are very close to one, indicating either very little migration or roughly equivalent rates of in- and out-migration.

Table 8-14. Distribution of self-reported strata and sampling strata for the landline/surname samples

Stratum	Sampling stratum	Self-reported stratum	Net agreement ratio
Los Angeles	7,128	7,123	1.00
San Diego	4,168	4,169	1.00
Orange	1,925	1,903	0.99
Santa Clara	1,162	1,199	1.03
San Bernardino	1,056	1,071	1.01
Riverside	1,350	1,354	1.00
Alameda	1,049	1,012	0.96
Sacramento	995	1,000	1.01
Contra Costa	657	704	1.07
Fresno	442	440	1.00
San Francisco	621	609	0.98
Ventura	465	481	1.03
San Mateo	505	487	0.96
Kern	473	470	0.99
San Joaquin	355	356	1.00
Sonoma	356	362	1.02
Stanislaus	408	394	0.97
Santa Barbara	424	423	1.00
Solano	400	397	0.99
Tulare	379	382	1.01
Santa Cruz	406	395	0.97
Marin	444	440	0.99
San Luis Obispo	411	412	1.00
Placer	388	398	1.03
Merced	419	431	1.03
Butte	373	383	1.03
Shasta	407	391	0.96
Yolo	370	359	0.97
El Dorado	378	383	1.01
Imperial	460	458	1.00
Napa	462	470	1.02
Kings	445	447	1.00
Madera	470	464	0.99

Table 8-14. Distribution of self-reported strata and sampling strata for the landline/surname samples (continued)

Stratum	Sampling stratum	Self-reported stratum	Net agreement ratio
Monterey	298	306	1.03
Humboldt	325	322	0.99
Nevada	442	435	0.98
Mendocino	436	431	0.99
Sutter	417	441	1.06
Yuba	482	432	0.90
Lake	462	457	0.99
San Benito	465	466	1.00
Colusa, Glenn, Tehama	334	351	1.05
Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, Trinity	299	300	1.00
Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, Tuolumne	345	348	1.01

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Sampling strata for the cell phone sample do not match exactly with those for the landline sample. Table 8-15 lists the cell sampling strata, with the stratum number for the landline sample. In order to compare agreement ratios similar to those for the landline sample, we need to classify the self-reported counties into the same areas covered by the sampling strata in the cellphone sample. These counts and the net ratio agreement are shown in Table 8-15 for adult respondents (excluding ported numbers that were sampled as part of the landline sample). The table shows that the net agreement is more variable than the same ratio for the landline sample. The reason is the mobility of the cell phones; the area where they are sampled does not always match the area where the respondent resides.

Table 8-15. Distribution of self-reported area and sampling strata for the cell phone sample

Sampling stratum	Counties covered	Sampling stratum	Self-reported area	Net agreement ratio
1	Los Angeles	1,892	1,886	1.00
2	San Diego	432	854	1.98
3	Orange	602	597	0.99
4	Santa Clara	401	425	1.06
5	San Bernardino	332	348	1.05
6	Riverside	336	331	0.99

Table 8-15. Distribution of self-reported area and sampling strata for the cell phone sample (continued)

Sampling stratum	Counties covered	Sampling stratum	Self-reported area	Net agreement ratio
7	Alameda	323	312	0.97
8	Sacramento, Placer	203	324	1.60
9	Contra Costa	158	181	1.15
10	Fresno, Tulare, Kings, Madera	458	446	0.97
11	San Francisco	149	191	1.28
12	Ventura	128	141	1.10
13	San Mateo	268	202	0.75
14	Kern	95	114	1.20
15	San Joaquin, Stanislaus, Merced	335	319	0.95
16	Sonoma, Solano, Napa	287	278	0.97
18	Santa Barbara	92	89	0.97
21	Santa Cruz	87	101	1.16
22	San Francisco, Marin	104	53	0.51
23	San Luis Obispo	97	98	1.01
26	Butte, Tehama, Glenn, Colusa	140	185	1.32
27	Shasta	117	96	0.82
28	Yolo, El Dorado, Nevada, Sutter, Yuba	671	497	0.74
30	San Diego, Imperial	526	76	0.14
34	Monterey, San Benito	257	253	0.98
35	Humboldt, Mendocino, Lake	309	320	1.04
43	Del Norte, Siskiyou, Trinity, Modoc, Lassen, Plumas, Sierra	56	100	1.79
44	Amador, Alpine, Calaveras, Tuolumne, Mariposa, Mono, Inyo	24	62	2.58

Source: UCLA Center for Health Policy Research, 2011 California Health Interview Survey.

9. VARIANCE ESTIMATION

This chapter describes the methods for and results of computing sampling errors for CHIS 2011-2012 data. The first section gives an overview of the reason for computing sampling errors and summarizes the precision of estimates for adults, children, and adolescents produced from the weights that include the landline, list, and cell phone samples. The remainder of the chapter describes the methodology for producing estimates of sampling variability. Section 9.2 is a general review of the two main methods of computing sampling errors or variances of estimates from surveys with complex sample designs like CHIS 2011-2012. Section 9.3 describes a replication method of variance estimation that can be used with the data. Section 9.4 shows how analysts can compute sampling errors for CHIS 2011-2012 estimates using commercial and open source software.

9.1 Design Effects

To evaluate the precision of sample estimates derived from a survey, sampling errors are computed. Estimates of sampling errors can be used to make inferences about the size of the difference between two population parameters based on the values of corresponding sample estimates, their estimated precision, and the expected probability distribution of such a difference. Suppose an analyst wishes to compare the proportion of employed persons whose employer offers health care benefits in two counties in California. By taking the estimated sampling error of this difference into account, the analyst can make inferences about the size of the difference.

Inferences of this nature require an estimate of the precision or sampling error of the characteristic being investigated. There is a variety of ways of reporting the estimated precision of a survey estimate including:

- A standard error (the standard deviation of the estimate);
- A variance of an estimate (the standard error squared);
- A coefficient of variation (the ratio of the standard error to the estimate); or
- A confidence interval (the estimate plus or minus a multiple of the standard error).

Another way of describing the variability of an estimate from a survey is by using the "design effect." The concept of a design effect was introduced and popularized by Kish, (1965) to account for the additional variability associated with complex sample designs involving stratification and clustering. The design effect is the ratio of the variance of the sample estimate for the survey (with its particular sample design and estimation method) to the variance of a simple random sample of the same sample size.

For a specific sample, the design effect, or *DEFF*, for an estimate from a survey can be estimated as

$$DEFF = \frac{\text{sampling variance of a complex sample}}{\text{sampling variance of a simple random sample}} .$$

At the analysis stage, the *DEFF* is useful because many procedures in statistical software assume the data are from a simple random sample when computing sampling errors of estimates. The *DEFF* can, in some circumstances, indicate the appropriateness of this assumption and can be used to adjust the sampling errors of the estimates to produce ones that are closer to the actual sampling errors (Skinner, Holt, & Smith, 1989).

Calculating the design effect for a proportion is straightforward because the variance of an estimated proportion in a simple random sample can be estimated easily. In this case, the estimated *DEFF* for a proportion is

$$DEFF_{PROP} = \frac{v(\hat{p})_{COMPLEX}}{v(\hat{p})_{SRS}} ,$$

where $\hat{p}$ is the estimated proportion, $v(\hat{p})_{SRS}$ is the variance estimate of the estimated proportion assuming a simple random sample, and $v(\hat{p})_{COMPLEX}$ is the variance of the estimated proportion accounting for the complex sample survey design.

In most surveys, design effects are larger than one. In CHIS 2011-2012, design effects are greater than one mainly because the cases have different estimation weights (Kish, 1992). As will be seen shortly, design effects from the survey are considerably greater than one for some statewide estimates.

Design effects are of primary interest to data users. They reveal that the complex sample design and estimation procedures used resulted in estimates of variances that are greater than what would be obtained from a simple random sample. A simple random sample design was not considered for CHIS 2011-2012, because it would not have achieved the sample sizes for the specific domains of interest, in particular at the county/stratum level, for given resources. The design effects calculated from the CHIS

2011-2012 data indicate that the sample design used in the survey needs to be taken into account when analyzing the data.

In CHIS 2011-2012, as in most large-scale surveys, a large number of data items are collected. Each resulting variable has its own design effect. One way to summarize the design effects for the items is to compute *DEFF*s for a number of items and then average them. This average represents the design effects for similar items from the survey, as described in Wolter, (1985).

The *DEFT* is the square root of the design effect, and it is similar to the *DEFF* but on the scale of the standard error of the estimate rather than the variance. Taking the square root of the *DEFF* has a smoothing effect on the variability.

The tables in the following sections show the *DEFF*s and *DEFT*s for selected items from the adult, the child or the adolescent interviews. The *DEFT* is often considered a more convenient measure than the *DEFF*, because it can be used directly when computing confidence intervals for the estimates. See Verma, Scott, & O'Muircheartaigh, (1980) for a discussion of the use of the *DEFT*. The main reason for presenting the *DEFT*s here is because it dampens some of the noise associated with the *DEFF*s. The maximum and minimum values of the *DEFF*s in the tables show that there is considerable variability in these quantities.

Before reviewing the tables in detail, it is important to discuss the most important factors that result in design effects larger than one. These factors are

- **Oversampling.** For the landline/list sample, the need for both county and state estimates required oversampling to produce stable estimates for these areas. This oversampling increased the design effect for statewide estimates. The cell sample also had disproportionate sampling because it was also allocated by county. However, when the samples are combined, persons in cell only households were subsampled.

- **Within-Household Subsampling.** For all samples only one adult was selected in each household. One child and/or adolescent was sampled in each household. This subsampling contributed to the differential weights at the person level because persons in households with more persons were subsampled at lower rates. In addition, young children (age 0 to 5 years) were sampled at twice the rate of older children (age 6 to 11 years)

- **Weighting Adjustments.** Differential weights were applied to reduce nonresponse bias and to make the estimates consistent with known population totals. The main reason for including these adjustments was to reduce biases in the estimates, but some of the adjustments may have increased the design effects for some estimates.

- **Composite weight.** The CHIS 2011-2012 weights combine samples from overlapping domains that were sampled at different rates.

9.1.1 Design Effect for the Combined Sample Weights

Table 9-1 to Table 9-3 present the *DEFF*s and *DEFT*s of the adult, child and adolescent interviews, respectively, for the landline/list/cell samples. The first panel in the tables shows the average, median, minimum, and maximum *DEFF*s computed for a combination of categorical and continuous variables. The rightmost panel shows the average *DEFT* for the same items. The *DEFF*s and *DEFT*s were calculated using 43 items selected from the adult interview, 26 items from the child interview, and 31 items from the adolescent interview. The variables include health characteristics such as general health rating, diagnosis (i.e., asthma, diabetes, high blood pressure, heart failure/congestive, heart disease, difficulty learning and remembering, child visited emergency room, felt nervous, had psychological or emotional counseling), lifestyle (smoking and alcohol, go to the park, had fast food), preventive medicine (mammogram, blood test, flu vaccine, delayed medical care, childcare), health insurance (insured, employer health insurance, other government health plan, prescription coverage), and socio economic and demographic variables (skipped meals, income, sexual orientation, marital status, education attainment, employed, servings of juice and vegetables, attended school last week). All were calculated by stratum.

Table 9-1 shows that in 33 counties the average *DEFT*s for estimates of adult items are between 1.26 and 1.55. This implies that for 75 percent of the strata the standard error of the estimates is about 26 to 55 percent greater than the expected standard error of a simple random sample. The average *DEFT* for the state estimates is 1.56. This is larger than the county-level *DEFT*s of 33 counties because most counties were not sampled proportional to their population.

Table 9-1. Average DEFF and DEFT for estimates from the adult interview

	Design effect (*DEFF*)				*DEFT*
Stratum	Average	Median	Maximum	Minimum	Average
State	2.51	2.49	3.77	0.21	1.56
Los Angeles	2.32	2.31	4.40	0.13	1.49
San Diego	3.09	2.96	4.89	1.33	1.74
Orange	2.15	2.10	3.73	1.19	1.45
Santa Clara	2.03	1.97	3.03	1.19	1.42

Table 9-1. Average DEFF and DEFT for estimates from the adult interview (continued)

Stratum	Design effect (*DEFF*)				*DEFT*
	Average	Median	Maximum	Minimum	Average
San Bernardino	2.17	2.22	4.68	0.66	1.46
Riverside	2.27	2.22	3.68	1.10	1.49
Alameda	2.04	1.96	3.36	1.42	1.42
Sacramento	2.06	1.98	4.77	0.59	1.41
Contra Costa	1.92	1.80	3.15	1.27	1.38
Fresno	1.68	1.63	2.81	0.86	1.29
San Francisco	1.91	1.85	4.00	0.27	1.36
Ventura	1.86	1.78	4.21	0.98	1.35
San Mateo	1.86	1.73	5.20	0.47	1.34
Kern	2.07	2.10	3.93	0.63	1.42
San Joaquin	2.03	1.99	5.80	0.80	1.40
Sonoma	1.61	1.59	2.40	0.67	1.26
Stanislaus	2.12	2.03	5.65	0.29	1.43
Santa Barbara	2.17	2.04	4.99	0.89	1.45
Solano	2.29	2.43	4.28	0.34	1.47
Tulare	2.00	1.96	3.26	0.73	1.40
Santa Cruz	2.00	2.22	3.21	0.30	1.39
Marin	3.04	2.64	12.23	0.34	1.66
San Luis Obispo	1.94	1.96	4.63	0.71	1.37
Placer	1.96	1.80	3.83	0.08	1.37
Merced	3.35	3.09	8.59	0.66	1.78
Butte	2.19	1.91	4.73	0.92	1.45
Shasta	2.00	2.03	3.72	0.11	1.39
Yolo	2.11	2.17	4.00	0.65	1.43
EL Dorado	1.87	1.76	4.07	0.58	1.35
Imperial	3.37	3.09	12.51	0.53	1.76
Napa	3.98	4.13	7.50	0.21	1.92
Kings	4.98	5.06	9.36	0.61	2.17
Madera	3.57	3.77	6.89	0.40	1.84
Monterey	1.68	1.53	4.45	0.75	1.28
Humboldt	2.70	2.27	6.66	0.79	1.59
Nevada	1.75	1.74	9.11	0.22	1.28
Mendocino	2.00	1.99	3.57	0.88	1.40
Sutter	2.08	2.13	3.83	0.23	1.42
Yuba	2.85	2.88	5.61	0.45	1.66
Lake	4.53	4.64	9.80	0.28	2.03
San Benito	6.84	6.11	18.39	0.34	2.48
Colusa, Glen, Tehama	2.51	2.39	5.32	0.88	1.55
Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, Trinity	1.79	1.70	3.33	1.12	1.33
Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, Tuolumne	2.00	1.89	4.21	0.46	1.39

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Table 9-2 shows the average *DEFT* for estimates from the child interview in each stratum for the all samples. The average *DEFT* at the state level is 1.73. In approximately 75 percent of the counties, the average *DEFT*s for the counties vary between 1.08 and 1.56; that is, the standard errors of these estimates are between 8 and 56 percent greater than expected from a simple random sample. Unlike previous cycles of CHIS, the state average *DEFT*s for estimates from the child interview are larger than those for the adult interview.

Table 9-2. Average DEFF and DEFT for estimates from the child interview

	Design effect (*DEFF*)				*DEFT*
Stratum	Average	Median	Maximum	Minimum	Average
State	3.06	2.90	5.52	1.58	1.73
Los Angeles	2.99	2.92	6.27	1.56	1.70
San Diego	3.56	3.54	7.00	0.27	1.85
Orange	2.36	2.30	3.74	1.12	1.52
Santa Clara	2.52	2.38	4.13	1.45	1.57
San Bernardino	2.46	2.37	3.86	1.29	1.55
Riverside	2.88	3.15	5.90	0.42	1.66
Alameda	3.04	2.57	5.29	1.33	1.72
Sacramento	2.58	2.53	4.53	0.73	1.57
Contra Costa	3.17	2.60	7.55	0.73	1.69
Fresno	2.02	2.22	3.85	0.01	1.33
San Francisco	2.51	2.24	8.00	0.19	1.49
Ventura	2.52	2.39	5.47	0.46	1.54
San Mateo	1.22	1.22	2.23	0.20	1.08
Kern	2.58	2.79	6.46	0.58	1.54
San Joaquin	2.25	2.50	3.48	0.32	1.46
Sonoma	1.63	1.67	3.00	0.27	1.23
Stanislaus	2.23	2.52	3.92	0.45	1.45
Santa Barbara	2.14	2.43	3.26	0.59	1.43
Solano	1.81	1.85	3.48	0.41	1.30
Tulare	1.69	1.80	2.85	0.21	1.26
Santa Cruz	1.79	1.80	3.26	0.24	1.28
Marin	2.07	2.01	4.44	0.49	1.40
San Luis Obispo	1.50	1.14	4.60	0.35	1.16
Placer	1.95	2.07	3.87	0.18	1.32
Merced	2.68	2.22	6.00	0.36	1.56
Butte	1.72	1.70	3.51	0.30	1.28
Shasta	2.36	2.47	7.42	0.39	1.44
Yolo	2.15	2.37	4.03	0.23	1.42
EL Dorado	2.06	2.04	5.05	0.19	1.38

Table 9-2. Average DEFF and DEFT for estimates from the child interview (continued)

Stratum	Design effect (*DEFF*)				*DEFT*
	Average	Median	Maximum	Minimum	Average
Imperial	2.76	2.98	4.84	0.78	1.61
Napa	1.67	1.53	3.79	0.45	1.25
Kings	3.88	3.85	10.38	0.51	1.86
Madera	3.87	4.25	6.62	0.19	1.85
Monterey	1.52	1.48	3.50	0.28	1.21
Humboldt	1.96	1.86	4.59	0.29	1.33
Nevada	1.45	1.23	2.95	0.74	1.18
Mendocino	1.25	1.35	2.34	0.32	1.09
Sutter	1.92	1.86	5.67	0.23	1.30
Yuba	2.53	2.04	6.28	0.61	1.52
Lake	2.73	1.94	8.07	0.04	1.55
San Benito	5.31	5.63	11.72	0.27	2.19
Colusa, Glen, Tehama	2.41	2.58	4.80	0.39	1.47
Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, Trinity	1.69	1.57	4.91	0.39	1.21
Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, Tuolumne	1.47	1.49	3.66	0.22	1.14

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

Table 9-3 shows that the average *DEFT* for items from the adolescent interviews are similar to those from the child interviews. Since the sampling for adolescents is similar to that for children, we expect a close correspondence between the two. The state average *DEFT*s are lower for adolescents than for children, primarily because there was no oversampling of adolescents by age and there are fewer adolescents than children per household, both of which reduce the variability in the weights. The average *DEFT* for the state estimates is 1.53. In 33 strata (75 percent) the average *DEFT*s are between 1.00 and 1.33.

Table 9-3. Average DEFF and DEFT for estimates from the adolescent interview

Stratum	Design effect (*DEFF*)				*DEFT*
	Average	Median	Maximum	Minimum	Average
State	2.36	2.30	3.08	1.54	1.53
Los Angeles	2.25	2.37	3.25	1.11	1.49
San Diego	1.93	1.99	2.75	0.97	1.38
Orange	2.00	2.09	3.00	0.80	1.40
Santa Clara	1.58	1.62	2.40	0.36	1.24
San Bernardino	1.81	1.80	3.00	0.43	1.33
Riverside	2.65	2.49	6.73	0.58	1.57
Alameda	1.29	1.43	2.21	0.59	1.12
Sacramento	1.96	1.76	4.58	0.55	1.36
Contra Costa	1.08	1.10	1.84	0.69	1.03
Fresno	1.45	1.42	3.18	0.83	1.19

Table 9-3. Average DEFF and DEFT for estimates from the adolescent interview (continued)

Stratum	Design effect (*DEFF*)				*DEFT*
	Average	Median	Maximum	Minimum	Average
San Francisco	1.25	1.17	2.20	0.48	1.10
Ventura	1.18	0.98	2.34	0.56	1.06
San Mateo	1.33	1.30	2.51	0.32	1.13
Kern	2.50	2.36	4.34	0.29	1.55
San Joaquin	1.13	1.11	2.04	0.38	1.04
Sonoma	2.11	1.98	3.87	0.65	1.42
Stanislaus	1.28	1.27	1.88	0.67	1.12
Santa Barbara	1.79	1.73	3.58	0.78	1.31
Solano	1.02	1.13	1.43	0.12	1.00
Tulare	1.51	1.61	2.45	0.56	1.21
Santa Cruz	2.03	2.24	4.11	0.44	1.37
Marin	1.34	1.22	2.06	0.59	1.14
San Luis Obispo	1.04	1.05	1.63	0.47	1.00
Placer	1.63	1.60	2.77	0.73	1.26
Merced	2.03	1.99	3.62	0.98	1.41
Butte	1.49	1.34	3.04	0.68	1.20
Shasta	1.35	1.32	2.73	0.54	1.13
Yolo	1.32	1.32	2.44	0.40	1.13
EL Dorado	1.81	1.74	3.87	0.55	1.31
Imperial	1.29	1.46	1.92	0.25	1.11
Napa	1.17	1.02	2.63	0.46	1.06
Kings	2.11	2.43	5.48	0.10	1.36
Madera	1.59	1.73	2.30	0.54	1.25
Monterey	1.85	1.82	4.59	0.52	1.33
Humboldt	1.70	1.79	3.25	0.50	1.28
Nevada	1.63	1.72	2.45	0.32	1.25
Mendocino	1.09	1.15	1.42	0.26	1.04
Sutter	1.27	1.27	1.72	0.77	1.12
Yuba	1.07	1.13	1.53	0.31	1.03
Lake	1.35	1.44	2.23	0.31	1.12
San Benito	2.01	2.27	3.29	0.48	1.38
Colusa, Glen, Tehama	1.60	1.58	2.51	0.68	1.24
Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, Trinity	1.47	1.45	2.53	0.36	1.19
Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, Tuolumne	1.53	1.42	2.67	0.53	1.22

Source: UCLA Center for Health Policy Research, 2011-2012 California Health Interview Survey.

9.2 Methods for Variance Estimation

Variance estimation procedures have been developed to account for the complex sample design. Using these procedures, factors such stratification, multistage sampling, sampling from different frames, and the use of differential sampling rates to oversample a targeted subpopulation can be appropriately reflected in estimates of sampling error. The two main methods are replication and linearization (i.e., the Taylor series approximation). Wolter (1985) presents a useful reference on the theory and applications of these methods. Shao (1996) has a more recent review paper that compares these methods. The rest of this section briefly reviews these methods.

The basic idea behind replication is to draw subsamples from the sample, compute the estimate from each of the subsamples, and estimate the variance of the original sample using the variability of the subsample estimates. Specifically, subsamples of the original "full" sample are selected to calculate subsample estimates of a parameter for which a "full-sample" estimate of interest has been generated. The variability of these subsample estimates about the estimate for the full sample can then be assessed. The subsamples are called replicates, and the estimates from the subsamples are called replicate estimates. Rust & Rao (1996) discuss balanced repeated replication (BRR) and jackknife replication, two general approaches to forming subsamples. They show how the units included in the subsample can be defined using variance strata and units. They also describe how these methods can be implemented using replicate weights.

Replicate weights are created to produce the corresponding replicate estimate. Each replicate weight is computed using the same estimation steps as the full sample weight but using only the subsample of cases comprising each replicate. Once the replicate weights are developed, it is a straightforward matter to compute variance estimates for sample estimates of interest. The variance estimate takes the following form:

$$v\left(\hat{\theta}\right) = c \sum_{k=1}^{G} \left(\hat{\theta}_{(k)} - \hat{\theta}\right)^2 \qquad (1)$$

where

θ is an arbitrary parameter of interest;
$\hat{\theta}$ is the estimate of θ based on the full sample;
$\hat{\theta}_{(k)}$ is the k^{th} estimate of θ based on the observations included in the k^{th} replicate;
G is the total number of replicates formed;
c is a constant that depends on the replication method; and
$v\left(\hat{\theta}\right)$ is the estimated variance of θ.

The other widely used method for variance estimation for complex sample surveys is called linearization and is based on the Taylor series approximation. In this method, the Taylor series linearization of a statistic is formed and then substituted into the formula for calculating the variance of a linear estimate appropriate for the sample design. Linearization relies on the simplicity associated with estimating the variance for a linear statistic even with a complex sample design.

9.3 Design of Replicates

In CHIS 2011-2012, a paired unit jackknife method (JK2[16]), a form of delete-a-group jackknife replication, was selected for computing variances. This section provides details on setting up the replication structure, including the definition of the variance strata and units.

Two major reasons for using replication to estimate variances for CHIS 2011-2012 are operational convenience and the ability to reflect all components of the design and estimation in the estimates of variability. With respect to operational convenience, once replicate weights are constructed, it is very simple to compute estimates of sampling errors. No special care is needed for subgroups of interest, and no knowledge of the sample design is required. If an estimator is needed that was not previously considered, replication methods can be easily used to develop an appropriate estimate of variance. In such a case, variance estimates using a Taylor series approach would require additional work. The variance estimation stratum and unit must also be included in the file for the Taylor series method.

The second reason for using replication is probably more important. The nonresponse, composite factor, and raking types of adjustments made in developing the CHIS 2011-2012 analysis weights all affect the sampling errors of the estimates produced from the survey.

Furthermore, the set of weights created in CHIS 2011-2012 combined samples from different frames and were raked to the same control totals. The replicate weights prepared for CHIS reflect all such aspects of weighting and raking. Currently existing software for using the Taylor series method for variance estimation cannot reflect these weighting adjustments. In some Taylor series software poststratification can be taken into account, but only in specific situations.

In the JK2 replication method, adjacent pairs of sampled telephone numbers are treated as having been sampled from the same stratum. Each pair of sampled telephone numbers is treated as an implicit stratum, where each such stratum is defined by the sort order used in the sample selection of telephone numbers. In this method, the constant, c, in equation (1) equals 1. This approach has been used in

[16]This method is denoted as JK2 in the software program, WesVar, which was used to compute all the sampling errors in this report.

previous cycles of CHIS and in other RDD studies such as the 2007 National Household Education Survey (Hagedorn, Roth, O'Donnell, Smith, & Mulligan, 2008).

The first step in designing the replicate structure is to determine the number of variance estimation strata. In the JK2 method, the number of replicates is equal to the number of variance estimation strata. The choice of the number of variance estimation strata is based on the desire to obtain an adequate number of degrees of freedom to ensure stable estimates of variance while not having so many as to make the cost of computing variance estimates unnecessarily high. Generally, at least 30 degrees of freedom are needed to obtain relatively stable variance estimates. A number greater than 30 is often targeted because there are other factors that reduce the contribution of a replicate to the total number of degrees of freedom, especially for estimates of subgroups.

For CHIS 2011-2012 and previous cycles of CHIS, we elected to create 80 variance estimation strata, even though many more could have been created. For the landline and cell phone samples, the 80 variance strata were formed as follows. First, the sampled telephone numbers were arranged in the same sort order used in sample selection. Next, adjacent sampled telephone numbers were paired to establish initial variance estimation strata (the first two sampled phone numbers were the first initial stratum, the third and fourth sampled telephone numbers were the second initial stratum, etc.). Each telephone number in the pair was randomly assigned to be either the first or second variance unit within the variance stratum. Each pair was sequentially assigned to one of 80 final variance estimation strata (the first pair to variance estimation stratum 1, the second to stratum 2, ..., the 80th stratum pair to stratum 80, the 81st pair to stratum 1, etc.). As a result, each variance stratum had approximately the same number of telephone numbers. The same process was followed for each sampling stratum.

Once the variance strata are created, the replicate weights can be created. The full replicate weights are constructed by first modifying the full sample base weights. The replicate base weight for replicate *k* for record *i* is

$$w_i^{(k)} = \begin{cases} 2w_i, \text{ if } i \text{ is in variance stratum } k \text{ and variance unit 1} \\ 0, \text{ if } i \text{ is in variance stratum } k \text{ and variance unit 2} \\ w_i, \text{ if } i \text{ is not in variance stratum } k \end{cases}$$

The same sequence of weighting adjustments used in the full sample weight is then applied to the replicate base weights to create the final replicate weights. Thus, all of the different components of the weighting process are fully reflected in the replicate weights, ranging from household adjustments (nonresponse, adjustment for household noncoverage, and adjustment to control totals) to person adjustments (nonresponse and raking).

9.4 Software for Computing Variances

In the past, most standard statistical software packages assumed a simple random sample when computing estimates of variance. As a result, estimates of variance from these packages had the potential to seriously understate the true variability of the survey estimates. However, in recent years, specialized commercial software has been developed to analyze data from complex surveys (Lepkowski & Bowles, 1996; Heeringa, West, & Berglund, 2010). In this section, we describe the elements needed to compute estimates for CHIS 2011-2012 using some of these programs.

WesVar Version 5.1 (Westat, 2007) is a free software package developed and distributed by Westat. WesVar uses replication methods to compute variance estimates. WesVar is an interactive program with a graphical interface that makes it simple to specify the estimates for sampling errors for estimates of interest. The data requests center on sessions called “workbooks.” A workbook is a file linked to a specific WesVar data set. In a workbook, the user can request descriptive statistics, as well as analyze and create new statistics. Descriptive statistics of analysis variables are produced through “table requests.” Regression requests support both linear and logistic regression models. Outputs include statistics of interest, such as the sum of weights, means, percentages, along with their corresponding standard errors, design effects, coefficients of variation, and confidence intervals.

To use WesVar with CHIS 2011-2012 data, the only requirements are to identify the full and replicate weights that are on the data file and specify the replication method as JK2. This specification is made when a workbook is opened. All of the standard errors produced will properly account for the sample design and estimation methods because these features are accounted for in the replicate weights.

SUDAAN® (Research Triangle Institute, 2012) is a package developed by Research Triangle Institute to analyze data from complex sample surveys. SUDAAN is available as a standalone package or it can be called using SAS. SUDAAN and WesVar produce the same point estimates. The difference between the two packages is in the method used to compute the variances. While WesVar uses replication exclusively, SUDAAN can use either a first-order Taylor series expansion approximation (linearization), or replication. When the Taylor series approximations are used, SUDAAN does not fully take into account complex weighting schemes such as nonresponse adjustments or raking, so the variance estimates will be different than estimates calculated using replication. On the other hand, if the user specifies replication as the variance estimation method, the estimates of variance computed in SUDAAN will take into account the sample design and weighting.

For descriptive statistics, SUDAAN offers two procedures: PROC CROSSTAB for categorical variables and PROC DESCRIPT for continuous variables. These procedures can be used to compute statistics of interest, such as sum of weights, means, and percentages along with their corresponding standard errors, design effects, and confidence intervals. Both procedures use the option DESIGN= to specify the type of survey design when calculating variance estimates. If no design type is specified using this option, then a standard “with replacement” design is assumed and linearization is used for variance estimation. Specifying JACKKNIFE assumes the use of replication. In this instance, the WEIGHT and NEST statements are also required. SUDAAN also contains procedures for computing other analytic statistics, such as those associated with linear and regression models. Consult the help manuals (available online) for more detail on the procedures and options available for SUDAAN.

Beginning in Version 9.1, SAS® has also included procedures to analyze survey data. Version 9.2 (SAS Institute Inc., 2012). In Version 9.2, these procedures can use either the linearization or replication methods (include the REPWEIGHTS statement) to estimate the variance. The procedures in SAS for analyzing survey data are SURVEYMEANS, SURVEYREG, SURVEYFREQ and SURVEYLOGISTIC. The SURVEYMEANS procedure computes estimates of means, proportions, percentiles, and totals, Estimates of differences or other linear combinations are not available in SURVEYMEANS. The SURVEYFREQ procedure produces one-way tand cross tabulation tables for survey data. This procedure also computes estimates of odds ratios and relative risk estimates. The SURVEYREG procedure fits linear regression models while SURVEYLOGISTIC performs logistic regression for survey data and fit various links including the cumulative logit, generalized logit, probit, and complementary log-log functions.

Another software package that can be used to analyze survey data is Stata 13 (StataCorp, 2013). Stata is a command driven, fully programmable statistical package used for managing, analyzing, and graphing data. Stata was developed by StataCorp and is available for a variety of platforms, including DOS, Windows, Macintosh, and UNIX. Stata’s statistical, graphical, and data management capabilities are fully expandable through programming.

Stata has a family of *svy*- commands to analyze data from sample surveys. The set of analytic methods in Stata is more exhaustive than any other package. The *svy* commands can be used to estimate a variety of quantities such as totals, proportions, means, linear combinations of means, and logistic regression parameters. Two-dimensional tables of totals and proportions, along with *DEFF*s for proportions can be produced using *svy* tab. The command *svy* mean can be used to produce the *DEFF*s for proportions by coding the analytical variable with values 0 and 1. To estimate totals using *svy* total, a variable with a value of 1 must be created for all records in the file. The *svy* command in the latest version of Stata can perform general linear modeling (glm command), nonlinear least squares estimation (nl command), and conditional logistic regression (clogit command) among others.

Another software package that can be used to analyze survey data is R (R Development Core Team, 2011) with the package *survey* (Lumley, 2012). R is a free software open source environment for statistical computing and graphics. It compiles and runs on UNIX platforms, Windows and MacOS. It is a command driven, fully programmable statistical language and environment used for managing, analyzing, and graphing data. The package *survey* has commands to analyze data from sample surveys such as description summary statistics, generalized linear models, Cox models, log-linear models, and general maximum pseudo-likelihood estimation for multistage stratified, cluster-sampled, unequally weighted survey samples. Like SUDAAN and SAS, the package *survey* in R can use linearization or replication depending how the design is defined using the command *svydesign*.

When using linearization to estimate variances the software packages referred to above require auxiliary variables that provide information about the sample design. Two variables have been defined and included in the data files (TSVARSTR and TSVRUNIT). TSVARSTR is required for all analyses, but TSVRUNIT is required only when analyses are performed using a combined data file with adults and teens, adults and children, or teens and children in the same file. In other words, when separate analyses are done by adults, children or teens the variable TSVRUNIT is not required. The definitions of TSVARSTR and TSVRUNIT are

- **TSVARSTR** (Taylor's series variance stratum). The variable TSVARSTR indicates the variance strata to be used for software that computes estimates of variance using the Taylor series method. The variable TSVARSTR was created by sequentially numbering the sampling strata separately by sample type.
- **TSVRUNIT** (Taylor's series unit). The variable TSVRUNIT indicates the PSU this case is the sampled household. In CHIS 2011-2012, the value of TSVARUNIT corresponds to the sequential numbering of sampled household within sampling stratum.

The same variables, TSVARSTR and TSVRUNIT, can be used for linearization variance estimation in SUDAAN, SAS, and STATA.

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APPENDIX A

Table A-1. CHIS 2011-2012 landline telephone sample frame sizes,[1] sample sizes,[2] and base weights by sampling stratum and sampling frame (RDD, Korean surname list, Korean and any other race but Vietnamese surname list, Vietnamese surname list, and American Indian/Alaska Native list)

Sampling stratum	Description	Landline sampling frame			Korean surname list			Korean & any other race but Vietnamese surname list			Vietnamese surname list			American Indian/ Alaska Native list		
		Average frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight
1.12	Los Angeles, San Fernando SPA – High Density	144,542	3,504	41.3	782	115	5.6	971	61	11.6	135	5	9.0	23	5	4.6
1.13	Los Angeles, San Gabriel SPA – High Density	366,041	17,350	21.1	1,300	189	5.1	8,598	499	9.4	3,958	23	8.5	103	23	3.8
1.14	Los Angeles, Metro SPA – High Density	393,364	27,852	14.1	2,164	320	4.6	2,373	136	7.8	218	32	6.4	129	32	3.8
1.17	Los Angeles, South SPA – High Density	116,134	5,736	20.2	629	91	5.2	1,167	67	10.1	233	8	9.0	36	8	3.3
1.18	Los Angeles, South Bay SPA – High Density	214,535	8,874	24.2	566	80	5.7	888	48	10.1	555	27	7.9	122	27	3.9
1.21	Los Angeles, Antelope Valley SPA – Low Density	226,875	12,590	18.0	125	18	4.5	149	10	8.3	167	13	9.8	48	13	2.8

Table A-1. CHIS 2011-2012 landline telephone sample frame sizes,[1] sample sizes,[2] and base weights by sampling stratum and sampling frame (RDD, Korean surname list, Korean and any other race but Vietnamese surname list, Vietnamese surname list, and American Indian/Alaska Native list) (continued)

Sampling stratum	Description	Landline sampling frame			Korean surname list			Korean & any other race but Vietnamese surname list			Vietnamese surname list			American Indian/ Alaska Native list		
		Average frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight
1.22	Los Angeles, San Fernando SPA – Low Density	1,710,663	27,386	62.5	1,752	267	6.0	2,405	140	13.5	1,748	119	10.9	496	119	3.9
1.23	Los Angeles, San Gabriel SPA – Low Density	952,728	16,530	57.6	1,208	184	6.0	6,839	412	13.2	3,905	82	11.5	324	82	3.7
1.24	Los Angeles, Metro SPA – Low Density	639,819	24,925	25.7	978	154	5.1	1,977	120	9.8	801	81	9.9	340	81	3.3
1.25	Los Angeles, West SPA – Low Density	1,023,572	14,334	71.4	679	105	5.9	1,305	75	14.0	306	51	11.8	209	51	4.0
1.26	Los Angeles, South SPA – Low Density	675,848	15,016	45.0	607	94	5.9	699	45	12.9	252	59	10.1	234	59	3.8
1.27	Los Angeles, East SPA – Low Density	779,503	18,367	42.4	630	106	5.5	1,247	80	11.4	504	125	10.3	498	125	3.7
1.28	Los Angeles, South Bay SPA – Low Density	1,067,834	17,441	61.3	1,395	209	6.1	2,206	130	12.5	1,443	143	11.8	574	143	3.7
2.1	San Diego – High Density	208,007	10,702	19.4	179	28	5.0	380	19	10.6	1,574	36	7.5	155	36	3.4

Table A-1. CHIS 2011-2012 landline telephone sample frame sizes,[1] sample sizes,[2] and base weights by sampling stratum and sampling frame (RDD, Korean surname list, Korean and any other race but Vietnamese surname list, Vietnamese surname list, and American Indian/Alaska Native list) (continued)

Sampling stratum	Description	Landline sampling frame			Korean surname list			Korean & any other race but Vietnamese surname list			Vietnamese surname list			American Indian/ Alaska Native list		
		Average frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight
2.2	San Diego – Low Density	189,152	5,057	37.4	90	15	4.7	160	7	16.0	1,154	133	10.4	541	133	3.7
3.1	Orange – High Density	355,109	13,175	27.0	227	39	5.2	325	20	10.8	389	127	9.0	504	127	3.3
3.2	Orange – Low Density	340,931	13,194	25.8	267	34	6.4	606	39	10.6	304	68	9.5	283	68	3.6
4.1	Santa Clara - High	307,858	15,976	19.3	81	11	5.1	190	13	7.3	354	179	8.9	754	179	3.6
4.2	Santa Clara - Low	343,985	15,025	22.9	202	29	6.3	307	17	12.8	226	140	8.4	550	140	3.5
5	San Bernardino	394,223	12,872	30.6	147	22	5.9	154	8	9.6	368	343	9.7	1,436	343	3.8
6	Riverside	387,234	12,889	30.0	331	50	5.5	711	38	11.7	794	481	9.0	1,977	481	3.7
7	Alameda	987,494	30,959	31.8	2,904	435	5.7	4,578	268	11.5	14,193	57	9.6	239	57	3.7
8	Sacramento	1,709,156	21,350	80.0	1,721	266	6.0	3,316	195	14.5	4,854	71	12.1	285	71	3.9
9	Contra Costa	552,976	15,882	34.8	640	100	5.5	2,719	156	11.5	6,981	1	9.9	8	1	8.0
10	Fresno	1,044,959	12,849	81.4	1,651	257	5.9	7,428	444	14.0	7,156	6	11.4	21	6	3.0
11	San Francisco	1,323,043	24,808	53.3	1,044	162	6.0	1,926	115	13.5	1,698	21	11.1	95	21	4.1
12	Ventura	1,385,830	28,156	49.2	1,003	152	5.8	1,525	90	13.0	1,915	57	10.9	240	57	4.0
13	San Mateo	1,512,423	23,957	63.1	2,009	306	5.9	10,088	594	13.4	4,907	13	11.1	62	13	4.1
14	Kern	1,172,391	21,953	53.4	932	146	5.4	2,762	163	13.3	3,509	709	11.1	2,853	709	3.8
15	San Joaquin	963,052	14,968	64.3	816	126	5.8	2,727	167	13.4	1,227	19	11.4	70	19	3.7
16	Sonoma	649,193	9,000	72.1	475	76	5.7	934	55	14.4	717	710	11.8	2,901	710	3.9
17	Stanislaus	1,091,927	21,066	51.9	1,600	246	6.1	12,088	719	12.4	2,985	7	11.1	22	7	3.1
18	Santa Barbara	638,278	10,370	61.5	367	56	6.0	656	37	13.7	610	76	14.2	297	76	3.8

Table A-1. CHIS 2011-2012 landline telephone sample frame sizes,[1] sample sizes,[2] and base weights by sampling stratum and sampling frame (RDD, Korean surname list, Korean and any other race but Vietnamese surname list, Vietnamese surname list, and American Indian/Alaska Native list) (continued)

Sampling stratum	Description	Landline sampling frame			Korean surname list			Korean & any other race but Vietnamese surname list			Vietnamese surname list			American Indian/ Alaska Native list		
		Average frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight
19	Solano	812,576	14,444	56.2	949	141	6.3	4,258	250	13.3	710	1	12.0	8	1	4.0
20	Tulare	521,444	9,050	57.6	239	32	7.2	250	13	13.9	294	358	11.3	1,486	358	3.8
21	Santa Cruz	432,455	7,072	61.2	324	49	6.1	688	39	14.0	1,120	66	10.9	302	66	4.0
22	Marin	451,155	5,767	78.2	283	43	6.0	336	17	15.3	395	30	11.3	116	30	3.7
23	San Luis Obispo	329,875	7,228	45.6	189	28	6.1	224	14	12.4	298	32	11.0	123	32	3.4
24	Placer	381,741	8,418	45.4	165	24	5.7	243	16	9.3	216	168	8.6	697	168	3.7
25	Merced	314,430	7,944	39.6	165	23	4.7	346	15	14.4	336	55	10.5	231	55	3.9
26	Butte	249,646	6,466	38.6	71	12	4.7	127	8	14.1	121	27	15.1	111	27	4.1
27	Shasta	264,642	7,503	35.3	121	19	5.3	208	12	11.6	132	3	10.2	8	3	2.0
28	Yolo	329,087	9,534	34.5	206	30	5.7	351	23	11.3	316	2	9.3	9	2	4.5
29	El Dorado	243,651	6,261	38.9	117	17	5.9	101	6	16.8	145	7	9.1	51	7	6.4
30	Imperial	321,490	7,030	45.7	212	26	6.8	288	20	11.5	292	281	13.3	1,178	281	3.8
31	Napa	126,472	7,529	16.8	85	13	5.3	143	10	6.5	126	20	10.5	83	20	4.0
32	Kings	166,780	4,651	35.7	110	16	5.5	116	6	14.5	183	631	10.8	2,576	631	3.7
33	Madera	153,571	4,910	31.3	91	15	4.8	39	2	9.8	79	265	9.9	1,090	265	3.6
34	Monterey	144,834	6,056	24.0	122	18	4.7	409	24	8.2	174	178	7.6	737	178	3.4
35	Humboldt	145,231	5,767	25.2	79	13	5.3	123	8	8.8	103	31	7.9	162	31	4.3
36	Nevada	88,623	7,183	12.3	36	5	6.0	69	3	8.6	29	1	7.3	14	1	4.7

Table A-1. CHIS 2011-2012 landline telephone sample frame sizes,[1] sample sizes,[2] and base weights by sampling stratum and sampling frame (RDD, Korean surname list, Korean and any other race but Vietnamese surname list, Vietnamese surname list, and American Indian/Alaska Native list) (continued)

		Landline sampling frame			Korean surname list			Korean & any other race but Vietnamese surname list			Vietnamese surname list			American Indian/ Alaska Native list		
Sampling stratum	Description	Average frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight	Frame size	Sample size	Weight
37	Mendocino	113,873	8,380	13.6	49	9	4.9	51	3	7.3	54	14	4.5	50	14	2.9
38	Sutter	71,643	7,258	9.9	47	8	3.4	39	2	9.8	38	107	4.2	482	107	3.0
39	Yuba	86,534	6,335	13.7	37	5	7.4	51	3	12.8	35	146	8.8	630	146	3.2
40	Lake	350,566	6,667	52.6	247	35	6.5	312	19	12.5	271	1	10.0	12	1	12.0
41	San Benito	118,691	4,350	27.3	56	9	4.7	46	3	11.5	62	358	20.7	1,473	358	3.6
42	Colusa, Glenn, Tehama	97,107	5,760	16.8	73	12	4.9	61	4	7.6	61	116	8.7	486	116	3.4
43	Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, Trinity	80,420	5,000	16.0	35	5	5.0	43	4	8.6	62	553	12.4	2,345	553	3.5
44	Amador, Alpine, Calaveras, Inyo, Mariposa, Mono, Tuolumne	52,210	6,722	7.8	28	4	4.0	35	2	8.8	45	139	3.8	641	139	2.9
	Total	30,317,424	727,398		33,637	5,099		93,361	5,513		75,837	7,612		31,530	7,612	

[1]Total number of possible phone numbers in eligible working 100 banks

[2]Realized number of sampled telephone numbers in strata.

Table A-2. CHIS 2011-2012 cell-phone sample frame size, sample sizes, and base weights by sampling stratum or area code

Sampling stratum	Description	Cell phone sampling frame			American Indian/Alaska Native list		
		Average frame size	Sample size	Weight	Frame size	Sample size	Weight
1	Los Angeles	13,027,004	31,174	417.9	385	91	4.2
2	San Diego	3,078,964	6,618	465.2	309	81	3.8
3	Orange	3,896,103	9,541	408.4	43	8	4.8
4	Santa Clara	1,963,542	5,783	339.5	15	2	7.5
5	San Bernardino	2,150,241	5,782	371.9	46	10	4.6
6	Riverside	2,907,106	5,843	497.5	103	30	3.4
7	Alameda	2,015,863	4,614	436.9	20	5	4.0
8	Sacramento, Placer	1,939,731	2,728	711.3	844	216	3.9
9	Contra Costa	1,117,496	3,179	351.5	11	3	3.7
10	Fresno, Tulare, Kings, Madera	1,577,910	6,457	244.3	884	216	4.0
11	San Francisco	915,283	2,264	404.3	14	2	7.0
12	Ventura	1,061,751	2,815	377.2	51	18	2.8
13	San Mateo	1,119,098	4,232	264.4	3	2	1.5
14	Kern	774,666	1,336	579.8	70	21	3.3
15	San Joaquin, Stanislaus, Merced	1,740,009	5,203	334.5	119	34	3.4
16	Sonoma, Solano, Napa	1,248,166	4,037	309.2	543	132	4.1
18	Santa Barbara	596,293	1,352	441.0	7	2	3.5
21	Santa Cruz	276,102	1,118	247.0	5	1	5.0
22	San Francisco, Marin	694,193	1,372	506.0	0	0	0.0
23	San Luis Obispo	219,142	1,377	159.1	14	3	4.7
26	Butte, Tehama, Glenn, Colusa	307,379	1,563	196.6	288	74	3.8
27	Shasta	252,751	1,199	210.7	101	20	5.1
28	Yolo, El Dorado, Nevada, Sutter, Yuba	663,719	9,389	70.7	419	110	3.6
30	San Diego, Imperial	1,131,643	7,152	158.2	326	85	3.7
34	Monterey, San Benito	480,605	3,494	137.6	5	1	5.0
35	Humboldt, Mendocino, Lake	170,400	3,392	50.2	114	29	3.7
43	Del Norte, Siskiyou, Trinity, Modoc, Lassen, Plumas, Sierra	74,852	1,350	55.5	12	3	3.0
44	Amador, Alpine, Calaveras, Tuolumne, Mariposa, Mono, Inyo	21,000	284	73.9	0	0	0.0
	Total	45,421,011	134,648		4,751	1,199	

APPENDIX B

Table B-1. Screener interview (households) weighting adjustments by sample type

	All Samples	Landline	List	Cell
1. Base weight				
1.1 Sample size	928,739	764,922	26,292	137,525
1.2 Sum of weights	76,365,987	30,632,975	192,606	45,540,406
1.3 Coefficient of variation		50.38	51.22	44.33
2. Adjusting for unreleased landline cell phone cases				
2.1 Sum of weights before adjustment				
a. Not a landline cell case	76,208,318	30,599,757	192,211	45,416,350
b. Released landline cell cases	124,056	0	0	124,056
c. Unreleased landline cell cases	33,613	33,219	395	0
2.2 Sum of weights after adjustment				
a. Not a landline cell case	76,208,318	30,599,757	192,211	45,416,350
b. Released landline cell cases	157,669	0	0	157,669
c. Unreleased landline cell cases	0	0	0	0
2.3 Sample size	927,767	763,994	26,248	137,525
2.4 Coefficient of variation		51.87	51.23	44.16
3. CATI extraction and adjusting for new work subsampling				
3.1 Sum of weights before adjustment				
a. Purged (nonresidential) telephone number	17,154,185	17,110,727	43,458	0
b. Not purged, not subsampled	54,324,942	12,743,634	148,753	41,432,556
c. Not purged, subsampled	4,886,859	745,396	0	4,141,464
3.2 Sum of weights after adjustment				
a. Purged (nonresidential) telephone number	17,154,185	17,110,727	43,458	0
a. Not purged, not subsampled	59,211,802	13,489,030	148,753	45,574,019
b. Not purged, subsampled	0	0	0	0
3.3 Sample size	896,270	745,866	26,248	124,156
3.4 Coefficient of variation		50.59	51.23	44.50

Table B-1. Screener interview (households) weighting adjustments by sample type (continued)

				All Samples	Landline	List	Cell
4.	First refusal conversion subsampling adjustment						
	4.1	Sum of weights before adjustment					
		a.	Household never refused	38,640,053	9,501,263	80,818	29,057,972
		b.	Household refused - selected for refusal conversion	20,571,749	3,987,767	67,935	16,516,048
		c.	Household refused - not selected for refusal conversion	0	0	0	0
	4.2	Sum of weights after adjustment					
		a.	Household never refused	38,640,053	9,501,263	80,818	29,057,972
		b.	Household refused - selected for refusal conversion	20,571,749	3,987,767	67,935	16,516,048
		c.	Household refused - not selected for refusal conversion	0	0	0	0
	4.3	Sample size		465,652	322,796	18,700	124,156
	4.4	Coefficient of variation			51.43	46.71	44.50
5.	Second refusal conversion subsampling						
	5.1	Sum of weights before adjustment					
		a.	Household never refused more than once	56,194,492	10,471,720	14,753	45,574,019
		b.	Household refused -selected for second refusal conversion	3,017,249	3,017,249	0	0
		c.	Household refused -not selected for second refusal conversion	61	61	0	0
	5.2	Sum of weights after adjustment					
		a.	Household never refused more than once	56,194,492	10,471,720	14,753	45,574,019
		b.	Household refused -selected for second refusal conversion	3,017,310	3,017,310	0	0
		c.	Household refused -not selected for second refusal conversion	0	0	0	0
	5.3	Sample size					
	5.4	Coefficient of variation			51.43	46.71	44.50

Table B-1. Screener interview (households) weighting adjustments by sample type (continued)

	All Samples	Landline	List	Cell
6. Adjusting for unknown residential status				
6.1 Sum of weights before adjustment				
a. Residential - respondents	12,341,247	2,570,208	38,292	9,732,747
b. Residential - nonrespondents	15,903,531	3,086,675	57,330	12,759,526
c. Unknown residential status (NA, NM)	11,171,108	4,544,172	32,400	6,594,536
d. Nonresidential	19,795,916	3,287,974	20,732	16,487,211
6.2 Sum of weights - allocating unknown residential				
a. Residential - respondents	12,341,247	2,570,208	38,292	9,732,747
b. Residential - nonrespondents	15,903,531	3,086,675	57,330	12,759,526
c. (NA, NM)	6,336,365	2,479,183	26,498	3,830,683
6.3 Sum of weights after adjustment				
a. Residential - respondents	12,341,247	2,570,208	38,292	9,732,747
b. Residential - nonrespondents	22,239,896	5,565,858	83,828	16,590,209
c. Estimated residential among unknown	0	0	0	0
6.4 Sample size	210,227	136,829	11,545	61,853
6.5 Coefficient of variation		65.38	43.69	47.72
7. Supplemental list-sample eligibility adjustment				
7.1 Sum of weights before adjustment				
a. RDD or Cell sample	34,459,023	8,136,066	0	26,322,956
b. Completed Korean, Vietnamese, or AIAN	18,542	0	18,542	0
c. Nonresponse, but known that is not Korean, Vietnamese, or AIAN	19,874	0	19,874	0
d. Nonresponse, unknown Korean, Vietnamese, or AIAN status	83,703	0	83,703	0
7.2 Sum of weights after adjustment				
a. RDD or Cell sample	34,459,023	8,136,066	0	26,322,956
b. Completed Korean, Vietnamese, or AIAN	59,260	0	59,260	0
c. Nonresponse, but known that is not Korean, Vietnamese, or AIAN	62,860	0	62,860	0
d. Nonresponse, unknown Korean, Vietnamese, or AIAN status	0	0	0	0
7.3 Sample size	203,218	136,829	4,536	61,853
7.4 Coefficient of variation		65.38	37.93	47.72

Table B-1. Screener interview (households) weighting adjustments by sample type (continued)

	All Samples	Landline	List	Cell
8. Unknown presence of children in household				
8.1 Sum of weights before adjustment				
a. Ineligible respondent	3,889,793	13,266	0	3,876,527
b. Eligible respondent - child status known	8,534,127	39,521	120,965	5,856,220
c. Eligible nonrespondent - child status known	52,354	39,521	471	12,363
d. Unknown nonrespondent - child status unknown	22,104,868	5,526,338	684	16,577,846
8.2 Sum of weights after adjustment				
a. Ineligible respondent	3,889,793	13,266	0	3,876,527
b. Eligible respondent - child status known	8,586,481	2,596,463	121,436	5,868,583
c. Eligible nonrespondent - child status known	0	0	0	0
d. Unknown nonrespondent - child status unknown	22,104,868	5,526,338	684	16,577,846
8.3 Sample Size	202,659	136,309	4,524	61,826
8.4 Coefficient of variation		64.99	37.84	47.70
9. Screener nonresponse adjustment				
9.1 Sum of weights before adjustment				
a. Respondents	12,413,398	2,609,729	58,559	9,745,110
b. Nonrespondents	22,167,744	5,526,338	63,560	16,577,846
9.2 Sum of weights after adjustment				
a. Respondents	34,581,143	8,136,066	122,120	26,322,956
b. Nonrespondents	0	0	0	0
9.3 Sample size	92,197	62,813	2,346	27,038
9.4 Coefficient of variation		63.88	111.83	47.45
10. Multiple telephone adjustment				
10.1 Sum of weights before adjustment	24,051,161	8,085,763	122,120	15,843,279
10.2 Sum of weights after adjustment	23,905,643	7,940,244	122,120	15,843,279
10.3 Sample size	81,190	62,499	2,346	16,345
10.4 Coefficient of variation		64.62	11.83	47.87
10.5 Overall adjustment factor	99.4%	98.2%	100.0%	100.0%

Table B-1. Screener interview (households) weighting adjustments by sample type (continued)

	All Samples	Landline	List	Cell
11. Duplicate respondent adjustment				
11.1 Sum of weights before adjustment				
a. Not a duplicate number	23,903,003	7,938,957	122,120	15,841,926
b. Duplicate number	2,640	1,287	0	1,353
11.2 Sum of weights after adjustment				
a. Not a duplicate number	23,905,643	7,940,244	122,120	15,843,279
b. Duplicate number	0	0	0	0
11.3 Sample size	81,175	62,489	2,346	16,340
11.4 Coefficient of variation		64.62	111.83	47.84
12. Section G nonresponse adjustment*				
12.1 Sum of weights before adjustment				
a. Household with child 1st procedure	554,217	546,297	7,919	0
b. Household w/o child 1st procedure - section G completed	13,106,443	4,003,454	58,629	9,044,360
c. Household w/o child 1st procedure - section G not completed	10,244,983	3,390,493	55,572	6,798,919
12.2 Sum of weights after adjustment				
a. Household with child 1st procedure	554,217	546,297	7,919	0
b. Household w/o child 1st procedure - section G completed	23,351,426	7,393,947	114,200	15,843,279
c. Household w/o child 1st procedure - section G not completed	0	0	0	0
12.3 Sample size	46,705	36,059	1,255	9,391
12.4 Coefficient of variation		70.67	111.31	48.50

* Adjustment applicable to the child and adolescent samples. See Section 5.1.

Table B-2. Extended interview weighting procedures for adult interviews by sample type

		All Samples	RDD	List	Cell
1.	Adult Base Weight				
1.1	Number of Sampled Adults	81,175	62,489	2,346	16,340
1.2	Sum of Weights	35,124,854	16,999,323	271,978	17,853,553
1.3	Coefficient of Variation		84.26	120.27	66.59
2.	Nonresponse Adjustment				
2.1	Sum of Weights Before Adjustment				
	a. Eligible Respondents	17,643,128	7,984,047	122,599	9,536,483
	b. Ineligible	296,351	156,827	5,770	133,745
	c. Nonrespondents	17,185,375	8,858,450	143,600	8,183,325
2.2	Sum of Weights After Adjustment				
	a. Eligible Respondents	34,532,965	16,669,446	260,004	17,603,515
	b. Ineligible	591,889	329,877	11,974	250,037
	c. Nonrespondents	0	0	0	0
2.3	Number of Completed Interviews	42,935	432,690	1,094	9,151
2.4	Coefficient of Variation (CV)		85.81	123.95	59.97
2.5	Mean Adjustment Factor	1.99	2.09	2.12	1.85

Table B-3. Extended interview weighting procedures for child interviews by sample type

	All Samples	RDD	List	Cell
1. Child Base Weight				
1.1 Number of Sampled Children	10,058	7,718	301	2,039
1.2 Sum of Weights	10,087,852	3,379,451	44,600	6,663,801
1.3 Coefficient of Variation		124.30	119.78	82.87
2. Nonresponse Adjustment				
2.1 Sum of Weights Before Adjustment				
a. Eligible Respondents	7,318,606	2,458,598	31,757	4,828,251
b. Ineligible	108,877	21,292	465	87,120
c. Nonrespondents	2,660,370	899,562	12,379	1,748,429
2.2 Sum of Weights After Adjustment				
a. Eligible Respondents	9,936,096	3,350,321	143,941	6,541,835
b. Ineligible	151,756	29,130	659	121,966
c. Nonrespondents	0	0	0	0
2.3 Number of Completed Interviews	7,334	5,600	211	1,523
2.4 Coefficient of Variation (CV)		127.09	115.55	80.77
2.5 Mean Adjustment Factor	1.38	1.36	1.38	1.35

Table B-4. Extended interview weighting adjustments for adolescent interviews by sample type

	All Samples	RDD	List	Cell
1. Teen Base Weight				
1.1 Number of Sampled Children	6,641	5,104	224	1,313
1.2 Sum of Weights	5,142,645	2,071,973	35,567	3,045,104
1.3 Coefficient of Variation		117.46	126.27	69.90
2. Nonresponse Adjustment				
2.1 Sum of Weights Before Adjustment				
a. Eligible Respondents	2,176,884	881,367	10,053	1,285,464
b. Ineligible	56,891	31,281	131	25,479
c. Nonrespondents	2,908,869	1,159,325	25,383	1,724,162
2.2 Sum of Weights After Adjustment				
a. Eligible Respondents	5,014,156	2,001,170	35,214	2,977,772
b. Ineligible	128,489	70,803	354	57,332
c. Nonrespondents	0	0	0	0
2.3 Number of Completed Interviews	2,799	2,164	78	557
2.4 Coefficient of Variation (CV)		125.95	160.79	71.29
2.5 Mean Adjustment Factor	2.36	2.27	3.50	2.32

Table B-5. Poststratification, composite weighting procedures, trimming, and raking adjustments for adult interviews by self-reported stratum

			All Strata
1.	Poststratification to telephone service		
	1.1	Number of Completed Interviews	42,935
	1.2	Sum of weights before poststratification	34,532,965
	1.3	Sum of weights after poststratification	43,561,904
2.	Composite weight		
	2.1	Sum of weights after composite factor	27,828,887
3.	Trimming Adjustment*		
	3.1	Number of Trimmed Records	34
	3.2	Sum of Weights Before Trimming Adjustment	27,828,887
	3.3	Sum of Weights After Trimming Adjustment	27,736,645
4.	Raking Adjustment*		
	4.1	Number of Completed Interviews	42,935
	4.2	Sum of Weights After Adjustment	27,796,484
	4.3	Coefficient of Variation (CV)	140.25
	4.4	Mean Adjustment Factor	1.00
	4.5	Mean Weight	647.41

*Counts of completed interviews and sums of weights in sections 1 and 2 are based on self-reported strata rather than sampling strata.

Table B-6. Poststratification, composite weighting procedures, trimming and raking adjustments for child interviews by self-reported stratum

			All Strata
1.	Poststratification to telephone service		
	1.1	Number of Completed Interviews	7,334
	1.2	Sum of weights before poststratification	9,936,096
	1.3	Sum of weights after poststratification	9,284,904
2.	Composite weight		
	2.1	Sum of weights after composite factor	6,154,945
3.	Trimming Adjustment*		
	3.1	Number of Trimmed Records	62
	3.2	Sum of Weights Before Trimming Adjustment	6,154,945
	3.3	Sum of Weights After Trimming Adjustment	5,946,412
4.	Raking Adjustment*		
	4.1	Number of Completed Interviews	7,334
	4.2	Sum of Weights After Adjustment	6,007,483
	4.3	Coefficient of Variation (CV)	159.89
	4.4	Mean Adjustment Factor	1.01
	4.5	Mean Weight	819.13

*Counts of completed interviews and sums of weights in sections 1 and 2 are based on self-reported strata rather than sampling strata.

Table B-7. Poststratification, composite weighting procedures, trimming and raking adjustments for adolescent interviews by self-reported stratum

			All Strata
1.	Poststratification to telephone service		
	1.1	Number of Completed Interviews	2,779
	1.2	Sum of weights before poststratification	5,014,156
	1.3	Sum of weights after poststratification	4,925,582
2.	Composite weight		
	2.1	Sum of weights after composite factor	2,987,029
3.	Trimming Adjustment*		
	3.1	Number of Trimmed Records	72
	3.2	Sum of Weights Before Trimming Adjustment	2,987,029
	3.3	Sum of Weights After Trimming Adjustment	2,788,609
4.	Raking Adjustment*		
	4.1	Number of Completed Interviews	2,799
	4.2	Sum of Weights After Adjustment	3,127,055
	4.3	Coefficient of Variation (CV)	129.00
	4.4	Mean Adjustment Factor	1.12
	4.5	Mean Weight	1117.20

*Counts of completed interviews and sums of weights in sections 1 and 2 are based on self-reported strata rather than sampling strata.