Technical Paper No. 1

The CHIS 2001 Sample: Response Rate and Representativeness

December 2003

Background

The California Health Interview Survey (CHIS) is designed to provide estimates for health indicators for the state's overall population plus local-level estimates for the populations of most California counties and estimates for major racial and ethnic groups, including a number of smaller ethnic groups.

To accomplish these goals requires a very large sample — 57,848 households in CHIS 2001 — specifically designed to generate these types of estimates. CHIS uses a telephone survey to collect data from the sample because that is the most cost-effective method for reaching such a very large sample that is geographically dispersed.

The CHIS sample is drawn from every one of the state's 58 counties and is designed to capture the diversity of the California population. CHIS 2001 is made up of 41 independent geographic area samples (33 of which are individual counties) that are combined to provide overall statewide results as well as results for each of the 41 geographic areas.[1]

CHIS is a population-based survey designed to be representative of California residents living in households with telephones. It includes three separate components: (1) a survey of all adults, ages 18 and older; (2) a survey of adolescents between the ages of 12 and 17; and (3) a survey of children under the age of 12 through interviews with their parents or guardians.

CHIS 2001 was translated and administered in six languages — English, Spanish, Chinese (Mandarin and Cantonese dialects), Vietnamese, Korean, and Khmer (Cambodian). Prior to translation, CHIS was reviewed by experts to assure its cultural compatibility with target population groups and to ensure that the language used did not exceed an eighth grade reading level.

There has never been a comparable, geographically complex, multidimensional health survey of this size and scope conducted in California or any other state. Getting the voluntary cooperation of adults, parents and adolescents to participate is certainly the survey's greatest challenge. The purpose of this paper is to provide information on how well CHIS 2001 represents the California population by examining the survey response rate and comparing CHIS sample characteristics with those of the 2000 Census and comparing estimates for health indicators with other statewide surveys.

Introduction

Every survey method used has limitations, and the use of telephone interviews for data collection is no exception. Telephone interviews are widely used for data collection. There are also well-tested techniques for designing questions for telephone-administered interviews. CHIS 2001 took full advantage of this wealth of measurement research and experience in designing its survey. However, good measures alone do not guarantee that the survey is representative of the population.

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[1] As a means to minimize respondent identification in the data, CHIS used a standard that each sampled area must have a population size of at least 100,000. This necessitated combining several counties with smaller populations.

Table 1.

Race Distribution of CHIS 2001 Respondents Compared to the 2000 Census

Race Category	2000 Census (adjusted*)	CHIS 2001
Native Hawaiian/Other Pacific Islander	0.2%	0.4%
American Indian/Alaska Native	1.1%	1.7%
African American	5.9%	4.7%
Asian	8.1%	7.1%
Other	10.7%	11.6%
White	70.4%	69.9%
Two or more races	3.5%	4.5%
	100.0%	100.0%

* Adjusted to compensate for the geographic stratification used in the CHIS sample design

A number of factors have complicated, eroded and challenged the conduct of telephone surveys for scientific research. Some of the factors that tend to reduce participation in scientific surveys include: households that do not have telephones, aggressive telemarketing by commercial entities, busy lifestyles of potential respondents, language and cultural communication issues, the growing use of cellular telephones, answering machines and voice mail, and widespread concern for protecting one's privacy and identity. To meet these challenges, the level of effort and the cost of carrying out telephone surveys have gone up in recent years.

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. 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.[2] A survey's response rate, however, is not the only, or even the best, measure of its quality. The key concern is how well the respondents represent the entire population. Any dimension that differs between the surveyed population and the population at large is considered a source of bias in the survey's findings. Thus, a survey with a high response rate combined with a large difference between the characteristics of the respondents and the population can result in substantially greater bias than a survey with a lower response rate and a more representative set of respondents.

Comparing CHIS 2001 to the 2000 Census

One of the best approaches to evaluate if a survey is severely biased is to examine how well the survey respondents match the demographic characteristics of the population at large. As an extreme example, it would be a serious problem if no Latinos participated in the survey. The CHIS 2001 sample can be examined using data from the 2000 Census, with Census data adjusted to the CHIS sample design to account for the fact that CHIS over-samples rural areas and under-samples the state's urban areas. Latinos make up 21.4 % of the unweighted CHIS sample; that corresponds almost exactly with the 21.2% found in the Census data. Table 1 shows similar correspondence with the Census proportions for the race categories in the unweighted CHIS sample.

There sometimes is a concern that low-income and high-income persons may not be well represented in telephone surveys. The CHIS 2001 sample included a higher than expected proportion of low-income persons and was very close to the expected proportion for high-income persons, Again reflected in the distributions of the unweighted CHIS 2001 sample and the 2000 Census (Table 2).

Weighting the CHIS Sample

CHIS, like any other telephone survey, can never eliminate all sources of bias. CHIS 2001 used a number of methodological and statistical techniques to minimize those biases that could be identified and ameliorated. In

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Table 2.

Household Income Distribution of CHIS 2001 Respondents Compared to the 2000 Census

Household Income*	2000 Census (adjusted)	CHIS 2001
< $10,000	8.9%	8.6%
$10,000-$15,000	6.1%	8.0%
$15,000-$20,000	6.0%	8.8%
$20,000-$30,000	12.1%	12.7%
$30,000-$40,000	11.5%	11.8%
$40,000-$50,000	9.9%	9.4%
$50,000-$60,000	8.6%	7.2%
$60,000-$100,000	21.3%	19.6%
$100,000 +	15.6%	14.0%
Total	100.0%	100.1%

* Annual household income using the CHIS variable HHINC and Census SF3, P52 series

addition to the random generation of telephone numbers for the CHIS 2001 sample, and the random selection techniques used in identifying CHIS respondents within households, the final data are statistically "weighted." The weighting first accounts for the different chances of selecting persons into the sample. These weights are further adjusted so that the weighted CHIS sample more closely mirrors the actual California population. These weights are based on the demographic picture provided by the 2000 Census for each of the 41 geographic areas, and for the state as a whole. Even with the large CHIS sample, this weighting process has sample size limitations that result in an "approximate" picture of the population and can never arrive at an exact adjustment. This is true for all surveys, and even more severely limited in surveys that are smaller than CHIS. Moreover, the CHIS weighting scheme also adjusts for the absence of non-telephone households from the sample (a known proportion based on the recent Census data for each of the 41 geographic areas in the CHIS sample).

Although all scientifically collected telephone survey data are generally weighted to some degree in order to minimize sample bias, researchers still have legitimate concerns about the persons missing from or underrepresented in the survey. These are persons for-whom the demographic characteristics used in the weighting scheme are either not addressed or are just not known. Statistical adjustments for even more

dimensions (for example, income and education distributions) are possible but are rarely if ever applied in smaller surveys. Researchers working with the CHIS data are encouraged to carefully review the CHIS *Weighting and Variance Estimation* methodology report[3] and consider further weighting depending on their research objectives and their ability to tolerate the limits of the CHIS sample sizes.

Enhancing Participation in CHIS

It has been shown in telephone surveys that people who are hard to reach are likely to be different from those who are easier to reach. CHIS 2001 made a minimum of 14 attempts to reach telephone numbers that were repeatedly busy or not answered or had answering machines. The survey industry standard is generally 5 to 8 attempts; attempts must be on different days, different times of day/evening, and must include weekends.

Counter to popular belief, persons who refuse to participate in telephone surveys are more likely to be similar to those who are willing to participate.[4] Nevertheless, CHIS 2001 tactfully pursued persons who less than adamantly refused to participate. Up to two attempts were made to "convert" these "refusal" persons into participants; the industry standard is generally one refusal conversion attempt.

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[3] *Weighting and Variance Estimation*, CHIS 2001 Methodology Series, Report 5, Los Angeles: UCLA Center for Health Policy Research, September 2002. (www.chis.ucla.edu/pdf/CHIS2001_method5.pdf)

[4] Safir, A, and F. Scheuren. "Nonresponse Bias in the 1999 National Survey of America's Families." Paper presented at the Joint Statistical Meetings, Indianapolis, IN August 16, 2000.

In addition to the callbacks, if an address could be matched to the refusing household, an express letter was mailed explaining the importance of participation. These letters were also available in the all CHIS languages so that the refusal conversion protocol could be applied equally across all language-eligible households where someone had refused. All of these efforts were designed to maximize participation in the survey, minimize bias in the sample, and enhance the survey's response rate.

The CHIS 2001 Response Rate

Comparing survey response rates is often complicated and confusing as a result of the use of different definitions, varying methods of calculation and, sometimes, outright misrepresentation. Professional groups such as the American Association of Public Opinion Researchers (AAPOR) and the Council of Survey Research Organizations (CASRO) have attempted to standardize the concept and methods of calculating response rate. Despite this, even the respected AAPOR offers six official ways to calculate response rate, with each equation potentially delivering a different answer. The method chosen for surveys usually depends on the intended audience and how revealing the survey researchers choose to be about their method of calculating response rates. Whatever method is used (if it has been used consistently), the fact remains that telephone survey response rates have been declining over time.[5]

CHIS 2001 uses a conservative method for computing its response rate: AAPOR's "Equation Number 4" called RR4. Using this RR4 equation, every eligible telephone number in the sample is included in the calculation's denominator ("eligible" means a residential telephone). CHIS 2001 also included in the denominator an empirically based estimation of how many residential telephone numbers might exist among all telephone numbers for which no eligibility determination could be made because they were always either busy or not answered. The CHIS overall response rate is calculated as the product of a "screener completion rate" and an "extended interview completion rate." The screener completion rate is the proportion of all eligible households in which someone answers the telephone and provides the necessary household information in order to randomly select an adult for the extended interview. The extended interview completion rate is the proportion of all selected adults who complete the extended interview; the latter rate is usually referred to as a survey's cooperation rate.

Additionally, since CHIS 2001 intentionally oversampled rural areas and under-sampled urban areas, the CHIS 2001 response rate had to be weighted to provide a balanced representation of an overall California response rate. This adjustment was important because rural areas had higher response rates than urban areas. For the adult survey, the weighted screener completion rate was a respectable 59.2% and the weighted extended interview completion rate was 63.7%. This gives an overall weighted response rate of 37.7% (59.2% x 63.7%). If the CHIS response rate is not weighted (and many stratified surveys report only unweighted rates), the screener and interview rates are higher at 65.7% and 65.9%, respectively. This gives CHIS 2001 an unweighted response rate of 43.3%. The 2002 Centers for Disease Control and Prevention's annual Behavioral Risk Factor Surveillance System (BRFSS) survey in California obtained an identical 43.3% response rate using the calculation method most similar to CHIS 2001.[6]

Many surveys report only their cooperation rate, which is higher than the final calculated response rate. The cooperation rate is defined as the ratio of completed interviews over the sum of completed interviews and refusals. Given the different methods for calculating this rate, the CHIS adult cooperation rate could range from the CHIS weighted rate (the most conservative) of 63.7% to a higher unweighted rate of 77.1% (using the simplest formula of the number of completed interviews divided by the number of completes plus all selected respondent refusals).

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[5]   Massey, JT, D. O'Connor, and K. Krotki. *Response Rates in Random Digit Dialing (RDD) Telephone Surveys,* Proceedings of the Survey Research Methods Section, American Statistical Association, 1997, and O'Rourke, et al. "An Inquiry into Declining RDD Response Rates, Parts I-III," *Survey Research* (Newsletter from the Survey Research Laboratory, College of Urban Planning and Public Affairs, University of Illinois at Chicago), 1998-9, Vol. 29, No. 2-3, and Vol. 30, No. 2-3.

[6]   AAPOR's RR4 equation. Note: since the BRFSS is not a stratified sample design, its response rate is not weighted.

Table 3.

**Prevalence of Current Smokers Among Adults (ages 18+),
CHIS 2001 and the 2001 California BRFSS**

	2001 BRFSS	*CHIS 2001*
Males	20.6% (18.3—22.9)*	20.0% (19.2—20.7)
Females	14.0% (12.4—15.6)	14.1% (13.6—14.6)
All Adults	17.2% (15.8—18.6)	16.9% (16.5—17.4)

* 95% confidence interval
Source: 11 April 2003 MMWR. "Prevalence of Current Cigarette Smoking
Among Adults and Changes in Prevalence of Current and Some Day Smoking
— United States, 1996–2001," p. 303 (www.cdc.gov/mmwr/PDF/wk/mm5214.pdf);
and CHIS 2001 Adult Public Use File, Version 2.

In spite of the attention paid cooperation rates and response rates, these are not necessarily the best measures of how representative a survey's sample is of the target population. The essential question is whether the persons responding to the survey are different with regard to their responses than the persons not responding. An 80% response rate is not "good" if the 20% who are non-responders all would have different answers from those who did respond. Doing a study of the non-respondents, ideal for examining differences between respondents and non-respondents, is both difficult and expensive — the reason that most surveys do not conduct these types of studies.

Benchmarking CHIS 2001

An additional way to assess a survey's representativeness is to compare its findings against the findings of other similar surveys. This is called "benchmarking." Comparing CHIS findings to those of other surveys in California is very encouraging.

A comparison of the estimated prevalence of current cigarette smokers in California using CHIS 2001 data with findings from the widely used 2001 California BRFSS shows very similar estimates. Table 3 demonstrates that using a reliable measure like current smoking status, CHIS has results that are virtually identical to those of BRFSS.

Comparable estimates are also seen for adults in California ever diagnosed with asthma and those with diabetes. Table 4 shows similar estimates for CHIS 2001 compared to an analysis of the 2001 BRFSS public use data, although BRFSS estimates are slightly higher. The lower estimates in CHIS 2001 are due to several factors.

One factor may be CHIS's greater inclusiveness of recent immigrants due to the availability of the survey interview in more languages; Latino and Asian recent immigrants tend to have lower rates of asthma and diabetes and would thus shift the average for all adults slightly downward. In addition, note in Table 4 the overlap of the estimate ranges between CHIS and BRFSS: the CHIS and BRFSS estimates are not statistically different. Furthermore, the CHIS estimates have narrower confidence intervals than the BRFSS estimates, which means that the estimates are statistically more precise.

These smoking, diabetes, and asthma prevalence examples are representative of a number of other CHIS 2001 findings that have been benchmarked against other data sources.[7]

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[7] There are no survey data on health insurance coverage that use measures comparable to those in CHIS. A thorough discus sion of differences between surveys that measure health insurance coverage is discussed in the appendix found in ER Brown, N Ponce, T Rice, and SA Lavarreda. *The State of Health Insurance in California: Findings from the 2001 California Health Interview Survey.* Los Angeles, CA: UCLA Center for Health Policy Research, 2002

Table 4.

**Prevalence of Current Smokers Among Adults (ages 18+),
CHIS 2001 and the 2001 California BRFSS**

	2001 BRFSS	*CHIS 2001*
Asthma**	12.1% (11.0—13.3)*	11.5% (11.2—11.9)
Diabetes**	6.5% (5.5—7.4)	5.9% (5.7—6.2)

* 95% confidence interval

*** Both surveys ask, "Have you ever been told by a doctor that you have [asthma]
[diabetes]?"*
*Source: CDC at www.cdc.gov/mmwr/preview/mmwrhtml/mm5049a1.htm; and CHIS
2001 Adult Public Use File, Version 2*

Conclusion

The CHIS 2001 response rate is comparable to response rates of other scientific surveys in California. Because survey sponsors calculate and report their response rates in different ways, it is important to be sure that any comparisons of response rates are based on the same methodology.

Furthermore, the CHIS 2001 sample yields unweighted and weighted population distributions and rates that are comparable to those obtained from other reliable sources. The demographic characteristics of the CHIS 2001 sample (such as race, ethnicity, and income) are very similar to those obtained from 2000 Census data. CHIS 2001 respondents have health characteristics and behaviors that also are very similar to those found in other reliable surveys.

It can be concluded that the CHIS 2001 survey data provide a reliable approximation of the California population along the health and demographic dimensions measured.