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CHIS 2003 Benchmarking of Key Estimates with Those from the National Health Interview Survey and the Medical Expenditure Panel Survey

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Introduction

Population-based data from surveys are a critical information source for monitoring public health. Response rates have declined markedly in the last decade. Although not a direct measure of data quality, low response rates increase chances and magnitudes of potential nonresponse bias. Given this, it is important to evaluating the representativeness of survey data as a tool for ensuring their qualities. One method frequently used for studying representativeness is to compare estimates from one survey to those from well-established surveys.

The purpose of the study is to assess potential nonresponse bias for a variety of estimates from California Health Interview Survey (CHIS), by comparing them to estimates from National Health Interview Survey (NHIS) and Medical Expenditure Panel Survey (MEPS). As one of the main sources for California's population-based data on health, understanding the representativeness of CHIS in comparisons to other surveys is important. NHIS and MEPS are nationally recognized population-based surveys administered in person which allows achieving higher response rates than telephone surveys, such as CHIS. Estimates examined in this study include demographic characteristics, health status indicators, health care access and key health insurance variables. A previous endeavor by the CHIS team compared CHIS and Behavioral Risk Factor Surveillance System titled, "The CHIS 2001 Sample: Response Rate and Representativeness," available at http://www.chis.ucla.edu/pdf/2001_response_representativeness.pdf

The current study was conducted in collaboration with the National Center for Health Statistics (NCHS) and Agency for Healthcare Research and Quality (AHRQ). Due to data disclosure limitations, analyses on NHIS and MEPS data were conducted at NCHS and AHRQ, respectively.

Data

We use three data sources: 2003 California Health Interview Survey (CHIS), 2003 National Health Interview Survey (NHIS), and 2003 Medical Expenditure Panel Survey (MEPS). CHIS is a random digit dial (RDD) telephone survey conducted biennially since 2001 by the University of California, Los Angeles Center for Health Policy Research in collaboration with the California Department Public Health, the Department of Health Care Services and the Public Health Institutes. NHIS has been conducted since 1957 by the National Center for Health Statistics (NCHS) and is a well-established annual survey extensively used by the public health research community. MEPS is a large-scale survey that collects information on health services and us conducted by the Agency for Healthcare Research and Quality (AHRQ). While the specific objectives of these surveys differ, all three surveys are conducted periodically to monitor the population's health, health care coverage, and access.

Methodological Differences

There are some significant methodological differences between the surveys that may affect the results of the analysis. First, while CHIS excludes all group quarter populations regardless of their institutionalization status from its target population, NHIS includes non-institutionalized group quarter populations from their frame; this difference, however, is insignificant.¹ MEPS uses the list of respondents from the previous year's NHIS as its frame and draws the sample from the list. Of course, CHIS targets the state of California, where as NHIS and MEPS targets the 50 States and the District of Columbia. For comparison purposes, only the California samples of NHIS and MEPS were used for this study.

Second, CHIS uses a geographically stratified RDD sample, while both NHIS and MEPS use an area-probability sample for their in-person interviews. Because NHIS and MEPS use an area-probability sample, it is likely that their samples cluster around large metropolitan areas. CHIS, on the other hand, ensures that each local stratum (a county or a group of small counties) has sufficient sample size for statistically stable estimation at the county level.

Third, for information about the adult household members, CHIS randomly samples only one adult per participating household and interviews with them.² In contrast, NHIS and MEPS have multiple modules that collect information about all household members from adult household informants as well as about selected individuals directly from themselves. In other words, for a selected adult, all information is collected from that adult in CHIS, whereas some information may be collected from a proxy respondent in NHIS and MEPS.

Fourth, CHIS interviews are conducted in English, Spanish, Chinese (Mandarin and Cantonese dialects), Vietnamese and Korean; NHIS in English, Spanish, and other languages (although what constitutes other languages is not clear); and MEPS in English and Spanish. While CHIS has standardized questionnaire in all their interview languages, NHIS and MEPS do in English and Spanish only. There is evidence that the estimates may differ dramatically depending on what languages are used in a survey (Lee et al., 2008) as the survey may miss distinctively unique linguistic minority groups if only major languages are used.

Differences in the sampling, interview mode and data collection method examined above contribute to differential response rates. Typically, in-person surveys achieve higher response rates than telephone surveys. Moreover, California as a whole is a more urban state in the U.S. and is among the most difficult parts of the nation to achieve high response rates (CDC, 2008). It is not surprising to find that the response rate for the

¹ There are 406,098 persons living in non-institutionalized group-quarters (e.g., college dorm, off-campus housing, group homes, religious group quarters, and other dorms) in the California adult population. Among these, 89,434 military populations living in on- or off-base military family housings and another 58,810 living in on-base military quarters were excluded from the NHIS frame.

² The only exception is a very small number of cases where proxy respondents are used when the selected adult is age 65 or older and is unable to participate due to poor health.

NHIS 2003 national selected adult sample is 74.2%, for its California sample 72.8% and for the MEPS2003 national household component sample 64.5%, while that for CHIS 2003 adult sample was about a half of those at 33.5%.

Lastly, these surveys employ different post-survey weighting procedures which may affect the results. CHIS uses ratio-raking on 11 dimensions of characteristics, such as age, gender, race/ethnicity, household composition, household tenure, and educational attainment at the state-, region- and county-level simultaneously. NHIS uses post-stratification with 88 cross-classifications of cells by age, race/ethnicity and gender at the national level. For this particular study, state-level weighting was carried out using 24 cross-classified cells by age, race/ethnicity and gender of California. According to Cohen (2005), MEPS modifies the NHIS weights for nonresponse at the dwelling-unit level by 49 cross-classified cells of age, gender, race, marital status, income, employment, telephone usage, dwelling unit size, region, residential area characteristics, and dwelling unit health characteristics. Cells were collapsed when necessary. Detail of the weighting is included in Appendix 1.

Analysis and Results

The sample size for CHIS was 42,044 adults (one in each household in the sample). The full NHIS national sample included around 92,000 adults from 36,000 households; the self-responding adult sample size was 31,000. For California, the corresponding NHIS sample sizes were 13,151 adults, 4,465 households and 3,709 self-responding adults. There were 22,684 adults in the MEPS national sample, where 3,395 adults were in California. In order to minimize the effect of methodological differences coming from proxy reporting (Lee, Mathiowetz, and Tourangeau, 2004), this study compares the CHIS sample of 42,044 adult and the NHIS California sample of 3,709 self-responding adults. However, MEPS estimates were computed based on both self- *and* proxy-samples of 3,395 due to data limitations.

In order to protect the data confidentiality, specific geographic information, such as state, is not included in the NHIS and MEPS public use data files. The analyses for NHIS and MEPS were conducted by NCHS and AHRQ. As not all variables are identical across these surveys, we examine the data in two steps. First, we compare all three surveys for a limited number of identical and similar variables. Then, we focus on comparing CHIS and NHIS on a series of variables. This is because MEPS is a specialized survey focusing on detailed health care utilization information and does not include a board range of health-related questions. On the other hand, NHIS and CHIS are general health surveys and include a number of identical and similar variables.

Comparison of NHIS, MEPS and CHIS

This section examines eleven variables identical in all three surveys (see Table 1). Because there are three sets of comparisons made in this analysis, we used Bonferroni

adjustment by using p-value=0.017 as the statistical significance criterion. The differences in age, gender, and race/ethnicity are statistically significant but very small. It is not surprising because these characteristics are controlled in the weighting process. The small difference come from the fact that the categories controlled in that process are not identical across the three surveys. The bottom panel of Table 1 shows the results of health and health care usage characteristics. While the general health of NHIS and MEPS match perfectly, CHIS shows higher proportions of fair and poor health report. MEPS and CHIS respondents reported higher rates of receiving flu shots than NHIS respondents. The health insurance coverage and health care utilization from MEPS appear to be substantially lower than the other two surveys; reports having insurance for the past full year, having usual source of care and seen doctor past year in the MEPS sample not only significant but also substantially lower than those in the NHIS and CHIS samples.

Table 1. Comparison of NHIS, MEPS and CHIS

	A. NHIS CA (n=3,709)		B. MEPS CA (n=3,395)		C. CHIS (n=42,044)	
	%	SE	%	SE	%	SE
Age						
18~64	87.5 ^{B,C}	(0.67)	85.3 ^A	(0.06)	85.3 ^A	(0.21)
65+	12.5 ^{B,C}	(0.67)	14.7 ^A	(0.06)	14.7 ^A	(0.21)
Sex						
Male	49.3	(0.89)	49.0	(0.23)	49.0	(0.34)
Female	50.7	(0.89)	51.0	(0.23)	51.0	(0.34)
Race/Ethnicity						
Latino	30.7	(0.91)	29.4 ^C	(0.23)	30.7 ^B	(0.34)
NL White	49.1	(1.10)	47.3 ^C	(0.39)	49.0 ^B	(0.33)
NL Black	6.0	(0.43)	5.5 ^C	(0.10)	6.1 ^B	(0.16)
NL Asian	12.1 ^B	(0.84)	14.6 ^{A,C}	(0.41)	11.6 ^B	(0.23)
NL Other	2.1 ^B	(0.30)	3.3 ^{A,C}	(0.21)	2.5 ^B	(0.09)
Fair/Poor Health	12.5 ^C	(0.61)	12.5 ^C	(0.31)	20.5 ^{A,B}	(0.29)
Asthma ever diagnosed	9.9 ^C	(0.55)	9.2 ^C	(0.17)	12.3 ^{A,B}	(0.22)
Insurance coverage past year (<65 yrs)						
Uninsured all yr	18.8 ^C	(0.84)	20.4 ^C	(0.33)	15.0 ^{A,B}	(0.31)
Uninsured part yr	9.2 ^{B,C}	(0.54)	13.7 ^{A,C}	(0.26)	10.7 ^{A,B}	(0.25)
Insured all yr	72.1 ^B	(0.96)	65.9 ^{A,C}	(0.40)	74.3 ^B	(0.36)
Visit a doctor past year	75.1 ^{B,C}	(0.89)	67.1 ^{A,C}	(0.32)	81.7 ^{A,B}	(0.29)
Have usual source of care other than ER	82.5 ^{B,C}	(0.80)	66.5 ^{A,C}	(0.54)	84.7 ^{A,B}	(0.27)
Flu shot in past 12 months (50+)	41.6 ^{B,C}	(1.64)	51.1 ^{A,C}	(0.56)	54.1 ^{A,B}	(0.50)
Pap smear ever (Women)	92.0	(0.74)	92.8	(0.26)	93.2	(0.27)
Mammogram ever (Women, 30+)	69.3 ^C	(1.53)	72.5	(0.57)	73.9 ^A	(0.43)

^{A, B, C} Estimates are statistically significantly different from NHIS, MEPS and CHIS estimates, respectively.

Comparison of NHIS and CHIS

This section reports results of comparing 31 variables identified to be common to NHIS and CHIS. These variables encompass demographics, socio-economic characteristics, health status and conditions, health risk factors, preventive service usage, health insurance coverage, and health care access. Appendix 2 shows that the comparability of these variables differs; some variables are identical, whereas others are similar in that they measure the same concept but use slightly different question wording or response categories.

The results of this analysis are shown in Table 2. There are many statistically significant differences, but they are mainly driven by the large sample size of CHIS. We will focus our discussion on substantial differences. First, the estimates of demographic and socio-economic variables are comparable, except for employment status. CHIS appears to include a higher proportion of full-time employees than NHIS by 4.1 percent point. Overall, these results indicate that the weighting methods implemented in the respective surveys are projecting the survey data to common population totals. The difference in the age distribution shown in Table 1 might have resulted from the differences in age categories used in the weighting between the two surveys, because the mean ages from the two surveys match perfectly.

Among all the health conditions and health behavior variables, the difference in general health between two surveys stands out. The report of fair or poor health in NHIS is 8.1 percent point lower than that in CHIS. This may be related to the question order effect described in Lee and Grant (2008). CHIS shows slightly higher rates of chronic diseases and cancer prevalence. The CHIS health insurance coverage report is higher by 4.4 percent point. CHIS also appears to have those utilizing health care services actively, as the proportions of doctor's visit in the past year, getting the flu shot, Pap smear test and mammogram are higher than NHIS. For instance, the flu shot estimate in CHIS is 12.5 percent point higher than NHIS. However, the direction of PSA screening difference is reversed. Overall, CHIS appears to have lower reports good health but higher insurance coverage and higher health care utilization. However, the CHIS estimates do not show dramatic discrepancies from the NHIS estimates, except for four variables: general health, seeing doctor past year, flu shot, and PSA screening.

Table 2. Comparison of NHIS and CHIS Estimates

Characteristics	NHIS CA		CHIS		Difference	
	Estimate	SE	Estimate	SE		
Demographics	Mean age in years	44.4	0.37	44.4	0.12	0.0
	Male	49.3	0.89	49.0	0.34	0.3
	Race/Ethnicity:					
	Latino	30.4	0.91	30.7	0.34	-0.4
	NL White	49.2	1.11	49.0	0.33	0.2
	NL Asian	12.4	0.86	11.6	0.23	0.8
	NL Other	8.1	0.51	8.6	0.18	-0.6
	Married	53.3	1.01	54.8	0.34	-1.5
Urban Residence	89.1	1.10	88.1	0.18	1.0	
Socio-economic	High school or lower education	43.4	1.02	44.1	0.34	-0.7
	Full-time employed (>20hr/week)	52.8	0.95	56.9	0.34	-4.1***
	<200% Federal Poverty Level	31.0	1.16	34.0	0.34	-2.9*
	Own home	57.3	1.35	55.9	0.34	1.4
	US Citizen	79.3	0.86	81.5	0.31	-2.1*
Health condition and behavior	Fair and poor general health	12.5	0.61	20.5	0.29	-8.1***
	Asthma ever diagnosed	9.9	0.55	12.3	0.22	-2.5***
	Hypertension ever diagnosed	22.1	0.77	23.5	0.28	-1.4
	Diabetes ever diagnosed	5.1	0.39	6.6	0.17	-1.5***
	Cancer ever diagnosed	6.6	0.47	8.3	0.16	-1.7***
	Skin cancer (All types)	36.8	3.82	38.6	0.93	-1.7
	Breast Cancer (Women)	23.5	3.93	28.2	1.10	-4.7
	Prostate cancer (Men)	25.9	4.76	25.9	1.38	0.0
	Height (cm)	166.3	0.20	168.5	0.81	-2.2***
	Weight (kg)	75.8	0.36	75.5	0.12	0.3
	Body Mass Index	26.5	0.10	26.6	0.04	-0.1
	Ever smoked 100 cigarettes	37.8	0.93	40.5	0.33	-2.7**
	Current smoker	43.2	1.46	40.8	0.53	2.3
Health insurance coverage and health care utilization	Insurance coverage at interview	79.0	0.82	83.4	0.29	-4.4***
	Insurance coverage past year (<65 yrs):					
	Uninsured all year	18.8	0.84	15.0	0.31	3.7***
	Uninsured part year	9.2	0.54	10.7	0.25	-1.5*
	Insured all year	72.1	0.96	74.3	0.36	-2.2*
	Insurance type (<65 yrs):					
	Uninsured	24.3	0.90	19.4	0.33	4.9***
	Medi-Cal	8.2	0.56	12.1	0.26	-3.9***
	Private purchase	63.1	1.11	65.9	0.37	-2.8*
	Other public	3.7	0.41	2.7	0.12	1.0*
Visit a doctor past year	75.1	0.89	81.7	0.29	-6.5***	
Have usual source of care other than ER	82.5	0.80	84.7	0.27	-2.1*	
Preventive service	Flu shot last year (50+ yrs)	41.6	1.64	54.1	0.50	-12.5***
	Pap test ever (Women 18+ yrs)	92.0	0.74	93.2	0.27	-1.2
	Mammogram ever (Women 30+ yrs)	69.3	1.53	73.9	0.43	-4.6**
	Prostate screening ever (Men 40+ yrs)	77.0	2.06	64.2	0.75	12.8***

* p<0.05, ** p<0.01, *** p<0.001

Conclusion

While the CHIS response rate is lower than that of NHIS and MEPS which are conducted in-person, the comparisons among the three surveys did not reveal striking differences. The differences were statistically significant mainly due to a large sample size of CHIS, but for most characteristics it is difficult to consider their differences substantial.

By no means, are survey estimates including those from CHIS free from error. The differences shown in Tables 1 and 2 are not a direct outcome of differential response rates. It is because, according to the total survey error paradigm (Groves, 1989), nonresponse is merely one of four survey error sources: noncoverage, sampling, nonresponse, and measurement. High response rates do not necessarily produce high quality data. For instance, one may use large financial incentives to increase response rates in a survey. This may attract a certain group in the population more than other groups and lead to systematic measurement error. With the incentives, the overall error of the survey may decrease, increase or stay the same. In spite of the fact that MEPS samples are drawn from NHIS respondents, NHIS and MEPS estimates behave differently. This may provide evidence for the existence of various error sources.

Moreover, a meta analysis by Groves and Peytcheva (2008) that examined response rates and nonresponse bias in 59 surveys found no clear association between nonresponse rates and nonresponse bias. Some surveys with response rates under 20% had a level of nonresponse bias that was similar to surveys with response rates over 70%. This is because nonresponse bias is a function of both the response rate and the difference in a variable of interest between respondents and nonrespondents or a function of covariance between response propensity and a variable of interest. Thus, response rates alone are not the determinant of nonresponse bias of the survey estimates. Although it may be convenient to use the response rate as a single indicator of a survey's representativeness and data quality, nonresponse bias is a property of a particular variable not of a survey.

Response rates are simply one of the many ways to summarize characteristics of a survey and may be a convenient, but not necessarily a scientific, tool to summarize nonresponse bias. This is well reflected in a statement by AAPOR (<http://aapor.org/responseratesanoverview>): “..... consumers of survey results should treat all response rates with skepticism, since these rates do not necessarily differentiate reliably between accurate and inaccurate data.” It is evident that a broader spectrum of error sources should be taken into consideration when evaluating survey data quality.

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Appendix 1. Weighting Methodology for NHIS 2003, MEPS 2003 and CHIS 2003 NHIS 2003

National-level

(adjusted quarterly using census figures for 6/30 of the survey year)

1. Hhld-level inverse of selection prob.
2. Hhld-level NR adjustment by Race and screening code
3. Person-level undercoverage ratio adjustment for non self-representing strata.
4. Person-level poststratification based on 88 cross-classified cells by
 - Age
 - Race/ethnicity
 - Sex

California (specially designed for the study)

Additional poststratification based on 24 cross-classified cells by

- Age
- Race/ethnicity
- Sex

MEPS 2003 (Cohen, 2004)

Modify national-level NHIS weight for NR at dwelling unit (DU)-level by 49 cross-classified cells using

- Income
 - <\$10K, 10-19K, 20-34K, 35+K,
 - Unknown
- DU size
 - 1,2, 3, 4, 5+
- MSA size
 - MSA with 500+K pop, MSA with
 - <500 K pop, Non-MSA
- Region
 - NE, MW, SO, W
- Employment classification
 - Gov, Private, Not in labor, Unknown
 - or <18 yrs
- DU-level personal help measure
 - At least one member unable to
 - perform personal care, Member 70+
 - yrs, Remainder
- Phone # provision in NHIS
 - Yes, No, No phone, Unknown
- Age
 - <25, 25-34, 35-44, 45-64, 65+
- Race/ethnicity

Hispanic, NH Black, NH Others
Sex
Marital status
Married, Others

Cells were collapsed according to the hierarchy of significance level

CHIS 2003

Initial Weight

1. Base weight
2. Subsample adjustment
3. Refusal subsampling adjustment
4. Unknown residential status adj
5. Supplementary sample race eligibility adj
6. Screener NR adj by mailable status
7. Multiple telephone adj

Weight Adjustment

1. NR adj w/n stratum for adult
Age
18-30, 31-45, 46-65, 66+
Sex
2. Wgt trimming
3. Raking by 11 dimensions
Age*Sex: Stratum
Age: Stratum
Age*Sex: State
SPA, Alameda County Cities
Race: Region
Race*Age: State
Asian*Age: State
Race*Age: Stratum
Education: State
of adults: State
Nontelephone adjustment: State
by housing tenure,
of adults, and
Education

Appendix 2. List of Variables and Comparability between CHIS and NHIS

Variable	Comparability
DEMOGRAPHIC CHARACTERISTICS	
Age	Identical
Gender	Identical
Ethnicity	Identical
Race/Ethnicity	Similar
Marital Status	Identical
Urbanicity	Identical
SOCIO-ECONOMIC CHARACTERISTICS	
Education	Identical
Employment status	Similar (slightly different categories)
Poverty level	Identical (but base questions differ)
Housing tenure	Identical
Citizenship	Similar (more specific categories in CHIS)
HEALTH STATUS, CONDITIONS and Behavior	
General health	Identical
Asthma ever diagnosed	Similar (NHIS specified a doctor and other health professional)
Hypertension ever diagnosed	Similar (NHIS specified a doctor and other health professional)
Diabetes ever diagnosed	Similar (NHIS specified a doctor and other health professional)
Cancer ever diagnosed	Similar (NHIS specified a diagnosis by a doctor or other health professional)
Skin cancer ever diagnosed	Similar (NHIS specified non-melanoma skin cancer of general skin cancer if the person does not know what kind)
Breast cancer ever diagnosed	Identical
Prostate cancer ever diagnosed	Identical
Height	Identical
Weight	Identical
BMI	Constructed by height and weight
Ever smoked 100 cigarettes	Identical
Current smoker	Identical
HEALTH INSURANCE COVERAGE	
Insurance coverage at the time of interview	Identical
Insurance coverage past 12 months	Constructed using different items
Insurance type	Constructed using different items
HEALTH CARE ACCESS	
Saw doctor past 12 months	Similar (NHIS asked whether the person has seen a doctor or other health professional)
Number of doctor visits past 12 months	Similar (NHIS asked how many times the person has seen a doctor or other health professional)
Have usual source of care other than emergency room (ER)	Constructed using identical items
PREVENTIVE HEALTH SERVICE UTILIZATION	
Flu shot last year	Identical
Pap smear ever	Identical
Mammography ever	Identical
Prostate cancer screening ever	Identical