Community Tracking Study

Household Survey Methodology Report 2003 (Round Four)

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Report on Survey Methods for the Community Tracking Study's 2003 Round Four Household Survey

Final Report

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I. OVERVIEW

A. OBJECTIVES OF THE COMMUNITY TRACKING STUDY

The Community Tracking Study (CTS) is the core research effort of the Center for Studying Health System Change (HSC), a nonpartisan policy research organization in Washington, DC, that is principally funded by the Robert Wood Johnson Foundation (RWJF). HSC's mission is to inform health care decision makers about changes in the health care system at the local and national levels, as well as about how such changes will affect people. HSC conducts surveys of those affected by changes in the health care system—households, physicians, and employers—and interviews with health care leaders in 12 communities.

The focus on markets is central to the design of the CTS. Understanding market changes requires studying local markets, including their culture and history, and public policies relating to health care. To track change across the United States, we randomly selected 60 nationally representative communities stratified by region, community size, and whether metropolitan or nonmetropolitan (see Table I.1).[1]

The CTS examines 12 of the 60 communities in depth by conducting site visits and using survey samples large enough to draw conclusions about health system change in each community. The 12 communities make up a randomly selected subset of sites that are metropolitan areas with more than 200,000 people (as of July 1992). We refer to these as *high-intensity* sites.

[1]The CTS covers the contiguous 48 states and the District of Columbia. Alaska and Hawaii are not part of the study.

TABLE I.1

SITES SELECTED FOR THE COMMUNITY TRACKING STUDY

High-Intensity Sites	Low-Intensity Sites		
Metropolitan Areas >200,000 Population[a]	Metropolitan Areas >200,000 Population[a]	Metropolitan Areas <200,000 Population[a]	Nonmetropolitan Areas
01-Boston MA	13-Atlanta GA	49-Dothan AL	52-West Central Alabama
02-Cleveland OH	14-Augusta GA/SC	50-Terre Haute IN	53-Central Arkansas
03-Greenville SC	15-Baltimore MD	51-Wilmington NC	54-Northern Georgia
04-Indianapolis IN	16-Bridgeport CT		55-Northeastern Illinois
05-Lansing MI	17-Chicago IL		56-Northeastern Indiana
06-Little Rock AR	18-Columbus OH		57-Eastern Maine
07-Miami FL	19-Denver CO		58-Eastern North Carolina
08-Newark NJ	20-Detroit MI		59-Northern Utah
09-Orange County CA	21-Greensboro NC		60-Northwestern Washington
10-Phoenix AZ	22-Houston TX		
11-Seattle WA	23-Huntington WV/KY/OH		
12-Syracuse NY	24-Killeen TX		
	25-Knoxville TN		
	26-Las Vegas NV/AZ		
	27-Los Angeles CA		
	28-Middlesex NJ		
	29-Milwaukee WI		
	30-Minneapolis MN/WI		
	31-Modesto CA		
	32-Nassau NY		
	33-New York City NY		
	34-Philadelphia PA/NJ		
	35-Pittsburgh PA		
	36-Portland OR/WA		
	37-Riverside CA		
	38-Rochester NY		
	39-San Antonio TX		
	40-San Francisco CA		
	41-Santa Rosa CA		
	42-Shreveport LA		
	43-St. Louis MO/IL		
	44-Tampa FL		
	45-Tulsa OK		
	46-Washington DC/MD/VA		
	47-West Palm Beach FL		
	48-Worcester MA		

Note: Numbers correspond to coding of the site identification variable in the survey.

[a]Based on 1992 Census estimates.

B. ANALYTIC COMPONENTS OF THE CTS

The CTS has qualitative and quantitative components, which we describe here:

- ***Site Visits.*** To examine the forces affecting health care organizations and how these organizations are responding, researchers interview health care leaders in each of the 12 high-intensity sites. HSC conducts and manages the site visits, with help from outside researchers.

- ***Household Survey.*** The main focus of this survey is assessing whether consumer access to the health care system is increasing or declining. We surveyed about 60,000 people in 33,000 families for each of the first three rounds of the survey. For Round Four (2003), the sample was made up of about 47,000 people in 25,000 families. Areas of inquiry include access, satisfaction, use of services, and insurance coverage. The survey also collects information on health status and sociodemographic characteristics. To enhance the reliability of information on health plans, we obtained selected information on plan characteristics from linked surveys of insurers for the first two rounds of the survey (followback survey). HSC provides technical direction and oversight, and Mathematica Policy Research, Inc. (MPR) is responsible for sample design, data collection, sample weights, and variance estimation for the household and followback surveys.

- ***Employer Survey.*** For the first round of the CTS (1996–1997), we interviewed 22,000 public and private employers to understand how the American population can access the health system nationally and locally. We asked these employers, which span size and industry sector, about the choice of plans they offer, how much their employees contribute to paying for their coverage, whether they participate in a purchasing alliance, and whether they provide high-quality information to their employees. HSC collaborated with RAND on the employer survey, which was not conducted for subsequent rounds.

- ***Physician Survey.*** For each round, a sample of practicing physicians across the country offers perspective on how health care delivery is changing. More than 12,000 physicians were interviewed for each of the first three rounds. For Round Four, approximately 7,000 physicians are expected to be surveyed during 2004–2005. Physicians respond to questions on whether they can provide needed services for patients, how they are compensated, what effect care management strategies have on their practices, and their practice arrangements. The Gallup Organization conducted the interviewing for the physician survey, and MPR is responsible for the sample design, sample weights, variance estimation, and tracing of physicians who could not be located.

Additional background on the CTS is available at HSC's website (www.hschange.org).

C. THE ROUND FOUR HOUSEHOLD SURVEY

This report describes the design and conduct of the fourth round of the household survey. MPR was the primary contractor for survey and sample design, data collection, sample weights, and variance estimation. Social and Scientific Systems, Inc. (SSS) converted the raw survey data into an analysis file. MPR and SSS collaborated with HSC to prepare the documentation for the public and restricted use files. Documentation of Rounds One through Three are included on HSC's website (Technical Publications 15, 34, and 46, respectively, at www.hschange.org).

The survey asks about health insurance, use of health services, satisfaction with care and health plans, health status, and demographic information. A family informant provided information on most topics for each adult and one randomly selected child. In addition, each adult answered subjective questions that a proxy respondent could not answer reliably. These included questions on unmet health needs, patient trust, satisfaction with physician choice and health plan, health status, risk behaviors, and details of the last physician visit. The adult family member who took the sampled child to his or her last physician visit was asked questions about that visit. (The adult may not have been the family informant.) A Spanish version of the instrument was used when appropriate. The survey was administered by computer-assisted telephone interview (CATI).

Although most respondents in each of the four rounds were selected through list-assisted random-digit-dialing (RDD) sampling methodology, families without working telephones were represented in the sample. Field staff using cellular telephones enabled these families to complete interviews.

A sample of the telephone numbers from the Round Three RDD sample was included in the Round Four sample to improve precision for estimates of change, reduce costs, and increase response rates. Although many people responded to more than one round, the samples were

designed to allow separate cross-sectional estimates and do not allow for panel or longitudinal analyses using data from prior rounds. The design does allow for comparisons of cross-sectional estimates between rounds.

After we contacted selected households, we determined the composition of each household, grouped household members into family insurance units (FIUs), and obtained information about each adult in the FIU. (The FIU is based on groupings of people typically used by insurance carriers. It includes an adult household member, spouse, and dependent children up to age 18, or ages 18 to 22 if the child is in school.)

Between February 2003 and February 2004, Round Four interviews with 46,587 people in 25,419 FIUs were completed. The weighted FIU-level response rate was 56.5 percent.

Reports describing the first three rounds of the household survey are included in Technical Publications 15, 34, and 46 on HSC's website (www.hschange.org). In this report, we discuss the sampling design of the Round Four sample (Chapter II), survey design and preparation (Chapter III), data collection (Chapter IV), and sample weighting (Chapter V). The appendices present the survey instruments (Appendix A), advance materials mailed to surveyed households (Appendix B), training manual (Appendix C), locator/screening manual for field data collection (Appendix D), and detailed response rate tables (Appendix E).

Editing and imputation procedures will be described in the Household Survey public and restricted use file user's guides for Round Four (forthcoming).

II. SITE SELECTION AND SAMPLE DESIGN

For the first three rounds of the Household Survey, interviews were administered to households in the 60 CTS sites and to an independent national sample of households, referred to as the "national supplement." (For a discussion of the sample designs used on prior rounds, see Technical Publications 15, 34, and 46.) To reduce the cost of the Round Four 2003 Household Survey, we eliminated the national supplement and reduced the number of cases in selected sites in the RDD sample.

Round Four Sample. Otherwise, the RDD sample design was largely unchanged from the Round Three 2000–2001 Household Survey. The field component was unchanged to ensure adequate representation of households without telephone access. The Round Four survey has a two-tier sample design, which makes it possible to develop estimates at the national and community (site) levels. The two tiers are:

1. A sample of 12 communities from which a large number of households in each community was surveyed. The sample in each of these "high-intensity" sites was large enough to support estimates in each site.
2. A sample of 48 communities from which a smaller sample of households in each community was surveyed. This sample of "low-intensity" sites enables us to validate results from the high-intensity sites and permits findings to be generalized to the nation. The first and second tiers make up the site sample.

In the following sections, we discuss site selection, changes in sample sizes between prior rounds and Round Four, sample tracking, procedures for selecting the RDD and field samples, and the process for forming households and families and selecting individuals.

A. SITE SELECTION

The primary goal of the CTS is to track health system change and its effects on people at the community level. Therefore, the first step in designing the CTS sample was to determine which communities, or sites, to study. For site selection, we needed to (1) define sites, (2) determine how many sites would be studied, and (3) select the sites.

1. Definition of Sites

We intended the sites to encompass the range of existing local health care markets. Although these markets have no set boundaries, we wanted to define areas such that residents predominantly used health care providers in the same area, and providers mostly served area residents. To this end, we defined sites to be metropolitan statistical areas (MSAs) as defined by the Office of Management and Budget or, for nonmetropolitan sites, to be the nonmetropolitan portions of Bureau of Economic Analysis economic areas (BEAEAs).

2. Number of Sites

Next, we needed to determine the number of high-intensity sites. We considered the trade-offs between data collection costs (the cost of conducting case studies and surveys) and the research benefits of a large sample of sites. The research benefits include a greater ability to empirically examine the relationship between system change and its effect on care delivery and consumers and increased "generalizability" of the study findings to the nation as a whole.

Despite the cost advantages of conducting intensive case studies in fewer sites, focusing on a small number of communities would have made it more difficult to distinguish between changes of general importance and changes or characteristics unique to a community. However, solving this problem by increasing the number of case study sites increases the cost of data collection and analysis. To balance these competing concerns, we chose 12 sites for intensive study and

added to this sample 48 sites that would be studied less intensively. The 60 high-intensity and low-intensity sites are primary sampling units (PSUs) and form the site sample (see Table I.1). For additional detail on the definition of CTS sites, see Metcalf et al. (1996). Although we had no formal scientific basis for choosing 12 high-intensity sites, the number reflects a balance between the benefits of studying a range of different communities and the costs of such a study. The addition of 48 low-intensity sites solved the problem of limited generalizability associated with only 12 sites and provided a benchmark for interpreting the representativeness of the high-intensity sites.

3. Site Selection

After we determined the number of sites for the site sample, the next step was to select the actual sites. The 60 sites were chosen for the first stage of sampling. Sites were sampled by stratifying them geographically by region and then selecting them randomly, with probability proportional to the size of their July 1992 civilian population (Metcalf et al. 1996). The CTS sites (or PSUs) were selected independently in three strata. The three strata were:

1. MSAs with 200,000 or more people (large MSAs)[1]
2. MSAs with fewer than 200,000 people (small MSAs)
3. Nonmetropolitan areas

For eight sites in the large MSA stratum, the population was sufficiently large that the site was selected with certainty. These eight sites were Boston MA (Portion); Philadelphia, PA-NJ, PMSA; Washington/Hagerstown PMSAs; New York City; Detroit, MI, PMSA; Chicago/Kenosha/Kankakee PMSAs; Houston-Galveston-Brazoria, TX, CMSA; and Los

[1]Some sites were defined as primary metropolitan statistical areas (PMSAs) or consolidated metropolitan statistical areas (CMSAs).

Angeles-Long Beach, CA, PMSA. A ninth site (Baltimore, MD, PMSA) was selected with certainty in the sample to complete coverage of the major cities of the Northeast Corridor.

In addition to the nine certainty selections, 39 sites were selected with probability proportional to size, using a sequential selection algorithm based on geographic region. This allocation ensured that (1) all MSAs had a chance to be selected, (2) larger MSAs had a greater chance than smaller MSAs of being selected, and (3) the site sample would have an approximately proportional allocation across geographic regions.

For the small MSAs, three sites were selected with probability proportional to size, again using a sequential selection algorithm with ordering by geographic region. For the nonmetropolitan areas, the first stage of selection was the state.[2] The states were selected with probability proportional to the size of their nonmetropolitan population, using the sequential selection algorithm (again ordered by geographic region); nine states were selected. Based on county groups used by the BEA, one county group was selected within each state with probability proportional to the population in these county groups.

Of the 60 sites in the CTS sample, 48 were selected in large MSAs, 3 in small MSAs, and 9 in nonmetropolitan areas. The 12 high-intensity sites were selected randomly from the 48 large MSA sites.

The site sample can be used to make national estimates and to make site-specific estimates for the high-intensity sites. However, samples for the low-intensity sites are too small to allow for precise site-specific estimates.

[2]New Jersey and Washington, DC, were excluded because they do not have any nonmetropolitan areas. Alaska and Hawaii were excluded from the CTS study design.

B. ROUND FOUR SAMPLE SIZES

1. Reduction in Sample Sizes Between Round Three and Round Four

For the first three rounds of the CTS Household Survey, we included an independent national sample of households in addition to the site sample. The purpose of the supplemental sample was to increase the precision of national estimates. We investigated the impact of eliminating the supplement to reduce the cost of the Round Four survey. We concluded that dropping the supplement would not reduce the range of analytic questions that the survey could address (although the statistical power to determine significant relationships was reduced for some analyses). Based on tests run on a number of variables, eliminating the national supplement increased standard errors for detecting differences for cross-sectional national estimates by an average of 5 percent and up to 10 percent for estimates of change between rounds. Even for variables where standard errors were increased, design effects were comparable to estimates included in the original design. In addition, many analyses that HSC conducts use multivariate models that include market-level variables from the 60 CTS sites among the independent variables; these analyses did not use the supplemental sample. Finally, eliminating the national supplement simplified the process of developing weights and made the data set easier for researchers to use.[3] A similar analysis was done for the 12 high-intensity sites, resulting in a decision to reduce the RDD samples in each of the high-intensity sites by about 25 percent, but retaining the field component as is.

Because of the decisions to eliminate the national supplement and reduce high-intensity site sample sizes, the RDD samples in high-intensity sites declined by an average of 295 FIUs and

[3]Additional information can be obtained from HSC staff.

536 people between Round Three and Round Four (see Tables II.1 and II.2, respectively).[4] The number of FIUs and people interviewed in the field sample fluctuated by site; overall, however, it changed little between rounds, from 925 to 806 and 1,370 to 1,241, respectively. The number of FIUs and people in low-intensity sites also declined slightly because of the elimination of the national supplement, since about half the observations in the supplement were in CTS sites. The reduction in the average number of FIU and individual sample cases in low-intensity sites was 37 and 67, respectively. The reduction was somewhat greater in the largest MSAs that had gained the most from the national supplement. For example, in New York, the decline in interviewed FIUs from Round Three to Round Four was 30 percent.

Overall, 25,419 FIUs and 46,587 people were interviewed in Round Four, compared to 32,669 FIUs and 59,725 people in Round Three. The number of FIUs per high-intensity site varied in Round Four from 831 to 1,040. In the low-intensity sites, the nominal sample sizes of FIUs ranged from 235 to 362. The variation among sites within the two groups can be explained by differential response rates.

2. Coverage from the Field Component

As in prior rounds, the sample design included a field sample to increase representation of FIUs and individuals who had little or no chance of being selected as part of the RDD sample because they lacked landline telephone service or had frequent disconnections of their service. The Current Population Survey (CPS) estimated that 4.5 percent of the population lacked

[4]As mentioned in Chapter I, household members were grouped into FIUs, based on groupings of people typically used by insurance carriers. The FIU includes an adult household member, spouse, and dependent children up to age 18 (or 18 to 22 if the child is in school).

TABLE II.1

CHANGE IN THE NUMBER OF FAMILY INSURANCE UNITS INTERVIEWED BETWEEN ROUND THREE AND ROUND FOUR, BY SITE AND BY SAMPLE

Site/Geographic Area	RDD			Field		
	Round Three	Round Four	Difference	Round Three	Round Four	Difference
High-Intensity Sites						
01-Boston (MA)	1,217	889	–328	36	16	–20
02-Cleveland (OH)	1,158	924	–234	62	49	–13
03-Greenville (SC)	1,146	838	–308	95	121	26
04-Indianapolis (IN)	1,124	881	–243	175	159	–16
05-Lansing (MI)	1,237	891	–346	25	35	10
06-Little Rock (AR)	1,295	892	–403	88	91	3
07-Miami (FL)	1,167	860	–307	68	40	–28
08-Newark (NJ)	1,159	855	–304	121	113	–8
09-Orange County (CA)	1,207	893	–314	19	11	–8
10-Phoenix(AZ)	1,070	754	–316	138	117	–21
11-Seattle (WA)	1,066	818	–248	49	13	–36
12-Syracuse (NY)	1,178	987	–191	49	41	–8
Low-Intensity Sites[a]						
13-Atlanta (GA)	268	269	1			
14-Augusta (GA/SC)	267	299	32			
15-Baltimore (MD)	307	308	1			
16-Bridgeport(CT)	288	250	–38			
17-Chicago (IL)	354	298	–56			
18-Columbus (OH)	345	282	–63			
19-Denver (CO)	319	297	–22			
20-Detroit (MI)	367	310	–57			
21-Greensboro (NC)	295	295	0			
22-Houston (TX)	322	290	–32			
23-Huntington (WV/KY/OH)	311	321	10			
24-Killeen (TX)	282	288	6			
25-Knoxville (TN)	288	284	–4			
26-Las Vegas (NV/AZ)	302	258	–44			
27-Los Angeles (CA)	385	279	–106			
28-Middlesex (NJ)	306	286	–20			
29-Milwaukee (WI)	327	277	–50			
30-Minneapolis (MN/WI)	354	305	–49			
31-Modesto (CA)	345	301	–44			
32-Nassau (NY)	321	266	–55			
33-New York City (NY)	389	272	–117			
34-Philadelphia (PA/NJ)	393	309	–84			

TABLE II.1 *(continued)*

Site/Geographic Area	RDD			Field		
	Round Three	Round Four	Difference	Round Three	Round Four	Difference
35-Pittsburgh (PA)	315	300	–15			
36-Portland (OR/WA)	385	305	–80			
37-Riverside (CA)	348	290	–58			
38-Rochester (NY)	434	362	–72			
39-San Antonio (TX)	342	299	–43			
40-San Francisco (CA)	276	235	–41			
41-Santa Rosa (CA)	293	307	14			
42-Shreveport (LA)	314	302	–12			
43-St. Louis (MO/IL)	382	319	–63			
44-Tampa (FL)	343	278	–65			
45-Tulsa (OK)	340	338	–2			
46-Washington (DC/MD)	370	275	–95			
47-W Palm Beach (FL)	295	264	–31			
48-Worcester (MA)	307	288	–19			
49-Dothan (AL)	339	296	–43			
50-Terre Haute (IN)	286	294	8			
51-Wilmington (NC)	275	264	–11			
52-W-Cen Alabama	365	339	–26			
53-Cen Arkansas	422	345	–77			
54-N Georgia	272	290	18			
55-NE Illinois	305	276	–29			
56-NE Indiana	293	316	23			
57-E Maine	333	292	–41			
58-E North Carolina	349	296	–53			
59-N Utah	434	334	–100			
60-NW Washington	354	283	–71			
Outside 60 Sites	1,814	0	–1,814			
Total	**31,744**	**24,613**	**–7,131**	**925**	**806**	**-119**

[a]Low-intensity sites had no field component.

TABLE II.2

CHANGE IN THE NUMBER OF INDIVIDUALS INTERVIEWED
BETWEEN ROUND THREE AND ROUND FOUR, BY SITE AND BY SAMPLE

	RDD			Field		
Site/Geographic Area	Round Three	Round Four	Difference	Round Three	Round Four	Difference
High-Intensity Sites						
01-Boston (MA)	2,200	1,556	–644	56	26	–30
02-Cleveland (OH)	2,085	1,676	–409	99	87	–12
03-Greenville (SC)	2,154	1,569	–585	144	193	49
04-Indianapolis (IN)	2,070	1,619	–451	258	225	–33
05-Lansing (MI)	2,283	1,666	–617	39	54	15
06-Little Rock (AR)	2,384	1,655	–729	155	157	2
07-Miami (FL)	2,035	1,552	–483	102	62	–40
08-Newark (NJ)	2,149	1,565	–584	166	163	–3
09-Orange County (CA)	2,179	1,622	–557	36	22	–14
10-Phoenix(AZ)	1,954	1,421	–533	187	172	–15
11-Seattle (WA)	1,921	1,470	–451	56	22	–34
12-Syracuse (NY)	2,211	1,824	–387	72	58	–14
Low-Intensity Sites[a]						
13-Atlanta (GA)	484	520	36			
14-Augusta (GA/SC)	494	535	41			
15-Baltimore (MD)	567	561	–6			
16-Bridgeport(CT)	552	477	–75			
17-Chicago (IL)	649	569	–80			
18-Columbus (OH)	654	559	–95			
19-Denver (CO)	576	581	5			
20-Detroit (MI)	686	561	–125			
21-Greensboro (NC)	539	530	–9			
22-Houston (TX)	613	563	–50			
23-Huntington (WV/KY/OH)	559	585	26			
24-Killeen (TX)	523	541	18			
25-Knoxville (TN)	516	516	0			
26-Las Vegas (NV/AZ)	522	462	–60			
27-Los Angeles (CA)	660	484	–176			
28-Middlesex (NJ)	600	557	–43			
29-Milwaukee (WI)	600	528	–72			
30-Minneapolis (MN/WI)	661	587	–74			
31-Modesto (CA)	653	562	–91			
32-Nassau (NY)	608	511	–97			
33-New York City (NY)	645	452	–193			
34-Philadelphia (PA/NJ)	706	548	–158			

TABLE II.2 *(continued)*

	RDD			Field		
Site/Geographic Area	Round Three	Round Four	Difference	Round Three	Round Four	Difference
35-Pittsburgh (PA)	572	524	–48			
36-Portland (OR/WA)	714	569	–145			
37-Riverside (CA)	672	567	–105			
38-Rochester (NY)	811	677	–134			
39-San Antonio (TX)	616	549	–67			
40-San Francisco (CA)	429	382	–47			
41-Santa Rosa (CA)	543	559	16			
42-Shreveport (LA)	571	521	–50			
43-St. Louis (MO/IL)	727	607	–120			
44-Tampa (FL)	589	489	–100			
45-Tulsa (OK)	623	624	1			
46-Washington (DC/MD)	691	527	–164			
47-W Palm Beach (FL)	508	444	–64			
48-Worcester (MA)	587	546	–41			
49-Dothan (AL)	659	552	–107			
50-Terre Haute (IN)	541	524	–17			
51-Wilmington (NC)	481	486	5			
52-W-Cen Alabama	658	609	–49			
53-Cen Arkansas	807	639	–168			
54-N Georgia	498	542	44			
55-NE Illinois	574	526	–48			
56-NE Indiana	580	595	15			
57-E Maine	605	549	–56			
58-E North Carolina	629	522	–107			
59-N Utah	946	722	–224			
60-NW Washington	650	511	–139			
Outside 60 Sites	3,382	0	–3,382			
Total	**58,355**	**45,346**	**–13,009**	**1,370**	**1,241**	**-129**

[a]Low-intensity sites had no field component.

telephone access in March 2002.[5] However, this estimate does not account for people who have cellular telephones but do not have access to landline telephone service. In a recent study based on 2003 CPS data, Tucker et al. (2004) estimated that 3.5 to 5.1 percent of households have no telephone service, and 4.9 to 6.0 percent of households have cellular telephones only. Using data from the 2003 National Health Interview Survey, Luke et al. (2004) estimated that 3.6 percent of households have only had cellular service Summing current estimates of households without telephones or with cellular telephone service only, it is likely that between 5 and 10 percent of eligible households for the 2003 survey would be excluded from an RDD sample frame.

Although we concluded that a field sample was necessary to provide coverage of people in households who did not have telephones or who had substantial interruptions in telephone service (see discussion later in this chapter), this entails much higher costs than does an RDD sample. Therefore, we limited the field sample to the 12 high-intensity sites, thereby representing households without continuous landline telephone service in MSAs with a 1992 population of 200,000 or more. For cost reasons, we rejected extending the field sample to represent small metropolitan areas and nonmetropolitan areas. For those areas, we developed specific weighting procedures to represent households with intermittent telephone service (discussed in Chapter V).

C. SAMPLE TRACKING AND THE LONGITUDINAL COMPONENT

Tracking a panel of individuals has considerable analytic appeal. Before Round Two, however, we concluded that this approach to sample tracking would be costly and subject to differentially higher nonresponse for people or entire households that move between surveys. We did not obtain social security numbers or other information typically used to minimize panel

[5]Tables from the CPS's branch of the Census Bureau, sent by letter from Maria Reed in July 2002.

attrition, such as addresses of friends or relatives. We attempted to obtain these data during Round One pilot testing, but the results were too incomplete to be useful. Moreover, the time required to trace movers for whom we did not have social security numbers or information on the addresses of friends and relatives would have extended the data collection schedule substantially. Furthermore, given changes over time in household and FIU composition, following households or FIUs would have been extremely difficult.

Instead, our approach to measuring changes in the population between rounds was to sample telephone numbers (for the RDD component) and addresses (for the field component) from each prior round. This approach is relatively simple to implement, less costly than tracking individuals, and avoids attrition resulting from inability to locate sample members.

This approach to tracking telephone numbers (or addresses) from round to round permits researchers to estimate population changes, such as changes in the percentage of adults covered by employer health insurance. For two reasons, the precision of these change estimates is theoretically greater than if estimates were made for the independent cross-sectional samples:

1. Use of the same sites in both rounds should improve the precision of estimates of change at the national level.
2. Partial overlap between rounds at the household level should improve the precision of site and national estimates of change.

These statements are rooted in theory, but they have been seen empirically in some of our analyses. However, the design does not permit researchers to make unbiased estimates of change in survey measures of health care for people (or FIUs or households), as individuals were not followed if they changed telephone numbers (or addresses, for the field component).

Following sampling units (the telephone numbers) other than the unit of observation (which, in the CTS, is the individual) has been used in other surveys. The CPS retains housing units in

its rotation groups, rather than following individuals or households (Robinson 1992; U.S. Bureau of the Census 2000). Kish (1965) described two annual surveys (1951 and 1952) that used the same dwellings in both years, with good results for change estimates. Kish mentioned cost and practicality issues when deciding which unit to sample to achieve overlap for longitudinal studies—we also considered these factors. Another large, predominantly telephone, survey—the National Survey of America's Families (NSAF) (Ferraro et al. 2000)—also used this approach.

Sampling the same telephone numbers is analogous to sampling the same dwellings. Because most people keep the same telephone number and address over a two-year interval, most of the people surveyed at those telephone numbers or addresses will be the same. Even when the telephone number has been reassigned, or different people occupy the dwelling, there will be some overlap. Unless the neighborhood has undergone major changes, new occupants or new people assigned the telephone number are likely to have demographic characteristics similar to those of former occupants or users. Therefore, some of the statistical gains in estimates from following individuals can be obtained by following telephone numbers or addresses, rather than the individuals themselves.

In designing the Round Four RDD sample, we employed a strategy similar to that used in Round Three, where we incorporated Round Two results that showed large variations in response rates and cost by Round One disposition. In Round Two, telephone numbers where Round One interviews were completed were more likely to yield an interview than were those in any other category. Therefore, the Round Two cost per interview for this group was relatively low. Conversely, telephone numbers where a refusal occurred in Round One yielded few interviews, and the cost per Round Two interview was high. Results for Round Three were consistent with those for Round Two. Using the principles of optimum allocation based on cost

and the experiences of Rounds Two and Three, we estimated optimal Round Four sampling rates for the following Round Three overlap categories:

- Telephone numbers where a Round Three interview was completed were sampled at 96 percent.
- Telephone numbers with "other nonresponse" at Round Three and hard refusers (those who refused two or more times) were subsampled at a rate of 17 percent.
- Telephone numbers that were not household numbers at Round Three were sampled at a rate of 21 percent.
- Telephone numbers where no contact was made in Round Three (no answer or answering machine) were sampled at a rate of 26 percent.

D. RDD SAMPLE SELECTION

In this section, we describe selection of the RDD samples for the Household Survey. The RDD site samples for the four rounds were similar, and strata were defined using the same criteria in all rounds. However, because the design called for a partial overlap, the second-, third-, and fourth-round RDD samples had new components. In the first round, all telephone numbers were selected for the first time, whereas the RDD samples for Rounds Two, Three, and Four included three groups of telephone numbers: (1) those that had been selected in the prior round *(overlap sample)*, (2) those that had no chance of selection in the prior round *(new sample—new working banks)*, and (3) those that had a chance of selection in the prior round but had not actually been selected *(new sample—old working banks)*. A working bank is defined as a set of 100 consecutive telephone numbers (XXX-YYY-ZZ00 to XXX-YYY-ZZ99) in which one or more numbers is a published residential number.

In the rest of this section, we describe the sampling frame used to select the RDD sample. We then discuss stratification, sample allocation, and generation and release of the RDD sample.

1. Sampling Frame

We used the Genesys Sampling System to select all the RDD household samples. Genesys selected the entire Round One sample and the samples from the old and new working banks in Rounds Two, Three, and Four. The overlap samples for Round Two, Three, and Four were selected from lists of the telephone numbers that had been attempted in the prior round.

To develop a sampling frame for a county or group of counties, Genesys first assigns each area code/exchange combination to a unique county.[6] Assignment is based on the addresses of published telephone numbers; a published number is one that appears in a regular ("White Pages") telephone company directory. An exchange is assigned to the county by the plurality of such addresses. Although this procedure can lead to occasional misassignment of numbers (assigning a telephone household to the wrong county), the misclassification rate is low. According to an analysis of published numbers in each of the 60 sites conducted before Round One, less than one percent of numbers assigned to any of the sites represented a household outside that site.[7]

Within each set of area code/exchange combinations, Genesys selects telephone numbers from working banks. Limiting the sample frame to working banks excludes approximately 3.5 percent of household numbers at any time (see Brick et al. 1995).

[6]In the 10-digit telephone numbering system used in the United States (XXX-YYY-ZZZZ), the first three digits (XXX) are referred to as the area code, and the next three (YYY) as the exchange.

[7]Data provided by Genesys at the time of Round One showed that an average of 99.1 percent of the sample in each site would live in that site and that the frame would cover an average of 99.2 percent of all land-based telephone households in a site.

2. Stratification and Sample Allocation

In all four rounds of the Household Survey, we used stratification in the high-intensity sites to help ensure proportionate representation.[8] We did not stratify samples in the low-intensity sites because the samples were too small. In the high-intensity sites, we stratified geographically and by such characteristics as income distribution, race/ethnicity distribution, or county, depending on the composition of a site. Strata were defined at the telephone exchange level, based on data provided by Genesys.

In high-intensity sites containing more than one county, we first stratified by county, assigning the county containing the central city of the MSA to one stratum and the other county or counties to another stratum. Next, we stratified the county containing the central city by race/ethnicity or income distributions. If that county included large black and Hispanic populations, we used both variables for stratification. If the county contained a significant fraction of only one of these population groups, or if one of these groups was dominant, we stratified by the percentage belonging to that group. For example, although Miami was approximately 18 percent black, a majority of the population was Hispanic. Therefore, we stratified on the percentage Hispanic. For sites in which neither the black nor Hispanic population was large enough to stratify on race or ethnicity, we stratified on income. Table II.3 shows the stratification variables for the high-intensity sites.

Although we used the same stratification criteria for all rounds, some exchanges could have "switched" strata, or even sites, between rounds. For example, the prevalence of Hispanic households in a Miami exchange could have changed between rounds. In practice, few such changes occurred. In Rounds Two and Three, less than one per cent of all exchanges changed stratum from the previous round, and fewer than 5 of the more than 15,000 exchanges changed

[8]We also used stratification for the supplemental sample in Rounds One, Two, and Three.

TABLE II.3

RANDOM-DIGIT-DIALING SAMPLE STRATA FOR HIGH-INTENSITY SITES

Site	Number of Strata	Stratifying Variables
Boston (MA)	3	Central city county (Suffolk) vs. remainder of site; within Suffolk, percentage black/Hispanic (0-49, 50-100)
Cleveland (OH)	3	Central city county (Cuyahoga) vs. remainder; within Cuyahoga, percentage black/Hispanic (0-49, 50-100)
Greenville (SC)	3	Central city county (Greenville) vs. remainder; within Greenville, percentage black (0-29, 30-100)
Indianapolis (IN)	3	Central city county (Marion) vs. remainder; within Marion, percentage black (0-49, 50-100)
Lansing (MI)	3	Central city county (Ingham) vs. remainder; within Ingham County, percentage with annual income $35,000 or higher (0-54, 55-100)
Little Rock (AR)	3	Central city county (Pulaski) vs. remainder; within Pulaski, percentage black (0-39, 40-100)
Miami (FL)	2	Percentage Hispanic (0-49, 50-100)
Newark (NJ)	3	Central city county (Essex) vs. remainder; in Essex, percentage black/Hispanic (0-49, 50-100)
Orange County (CA)	2	Percentage Hispanic (0-44, 45-100)
Phoenix (AZ)	3	Pinal County vs. Maricopa County; within Maricopa, percentage Hispanic (0-34, 35-100)
Seattle (WA)	3	Central city county (King) vs. remainder; within King, percentage with annual income $50,000 or higher (0-49, 50-100)
Syracuse (NY)	3	Central city county (Onondago) vs. remainder; within Onondago, percentage with annual income $35,000 or higher (0-49, 50-100)

site. In Round Four, 251 of 21,184 exchanges changed site. We devised two rules to deal with telephone numbers in exchanges that switched strata or sites:

1. If a telephone number was part of the overlap sample, it kept the site and stratum assignment from the prior round.
2. If a telephone number was selected for the first time in the current round but was part of an "old" working bank (one that had been working in the prior round), it was assigned to the site and stratum to which its exchange belonged in the prior round.

To determine the initial allocation of telephone numbers for each site, we considered the projected household prevalence among generated telephone numbers, or "hit rate," in each site and the expected response rate for each type of sample. Telephone numbers within sites were sampled to achieve equal probabilities of selection across strata. The initial allocation of telephone numbers was later adjusted on the basis of actual experience during the survey. Thus, if either the percentage of sampled telephone numbers that was residential or the response rate in a site was different than expected, we adjusted the allocation of telephone numbers to obtain the desired number of interviews.

We also varied the allocation of sample among overlap sample and new sample from the old and new working banks. For each low-intensity site, and each stratum in a high-intensity site, we:

- Estimated the expected number of completed interviews (FIUs) from the overlap sample (using the sampling rates for the four overlap groups described earlier)
- Estimated the sample size that should be generated from old working banks, while trying to achieve approximately equal probabilities of selection within strata (to reduce variance), and estimated the number of completed interviews from that sample
- Estimated the sample size that should be generated from new working banks to give numbers in these new banks the same probability of selection for Round Four as for cases in old working banks
- Estimated the number of completed interviews expected from the new working bank sample

- If the estimated number of completed interviews from the overlap and new working bank sample was less than the target number of interviews, calculated the additional amount of sampled telephone numbers needed from the old working banks[9]

As mentioned earlier, the high-intensity site samples were reduced in Round Four. Here, we summarize the approach we used to reduce these samples:

- Select all Round Three completes.
- Select Round Three noncompletes at the same rate as they were selected in low-intensity sites.
- Select sample in new working banks at approximately the same probability as the overlap sample.
- If the expected yield in a site from the overlap, new working bank samples, and old working bank sample is less than the revised target, select additional sample from old working banks.
- If the expected yield in a site from the overlap, new working bank samples, and old working banks is greater than the revised target, then the overlap sample will be reduced.

These procedures were designed to retain, to the extent possible, equal probabilities of selection between the overlap and non-overlap portions of the RDD sample, thereby minimizing an increase in the component of the design effects due to weighting for either national or site-specific estimates. The chief factor in reducing effective sample sizes was expected to come from the reduction in the nominal size of the sample.

3. Sample Selection and Release

The initial sample release was set at 45 percent of the total number of projected telephone numbers. The initial sample was released during January and February 2003. Subsequent sample releases were made for all sites to meet sample size and response rate targets. (See Table

[9]This process was iterative, as sampling from old working banks changes the probability of selection for the current round for the overlap sample, which requires adjustment to the new working bank sample, and so on. The iterations converged satisfactorily after two or three attempts.

II.4 for sample releases.) Toward the end of the survey, we tailored sample selection to meet interviewing targets in specific sites or groups of sites. The steps taken in selecting and releasing the sample were:

- Generating samples of telephone numbers
- Removing known business and nonworking numbers from the sample, using Genesys identification procedures
- Checking against prior releases for duplicates
- Randomly sorting the sample
- Releasing sample to the automated call scheduler
- Using data collection reports to reestimate the size of future releases

TABLE II.4

RELEASE OF SAMPLE FOR ROUND FOUR OF THE COMMUNITY TRACKING STUDY HOUSEHOLD SURVEY

Date	Total RDD	Round Three Completes	Round Three Hard Refuser and Other Nonrespondent	Round Three Other	New or Old Working Banks	Total Field
January 2003	3,044	2,068	0	976	0	
February 2003	18,239	13,926	0	4,313	0	
March 2003	4,262	1,969	2,293	0	0	
April 2003	3,815	0	0	0	3,815	
May 2003	8,627	3,018	0	0	5,609	
June 2003	1,824	0	0	0	1,824	
July 2003	2,018	2,018	0	0	0	4,154
August 2003	0	0	0	0	0	
September 2003	0	0	0	0	0	551
October 2003	3,722	0	0	0	3,722	424
November 2003	3,378	0	0	0	3,378	
Total	48,929	22,999	2,293	5,289	18,348	5,129

For new and old working banks in the non-overlap sample, the Genesys system uses random selection within equal size zones to select equal-probability RDD samples of telephone numbers for a sample release. Thus, if Genesys selects 1,000 numbers in a low-intensity site or in a stratum of a high-intensity site, all these numbers will have the same probability of selection. This method of sample generation is described more fully in documentation available from Marketing Systems Group (1994, 2000). The Genesys identification procedure had two steps: (1) checking the sample against lists of published numbers; and (2) dialing numbers to determine whether they were residential, nonresidential, or nonworking. In the first step, all numbers were classified as published residential numbers, published business numbers, or other. The published residential numbers were retained, the business numbers eliminated, and the others prepared for dialing. Genesys used an automated dialer to check for the tone that precedes a recorded message stating the number dialed was not in service (termed an *intercept message*). If that tone was detected, the number was removed from the sample as nonworking. If such a tone was not detected, Genesys allowed the number to ring twice. If the call was answered, a Genesys employee screened for residential status.[10] To minimize intrusiveness, calls were made only between 9:00 A.M. and 5:00 P.M. local time.

The overlap sample was selected randomly from Round Three sample within each stratum (in high-intensity sites) or low-intensity site. Although the overlap sample had been generated in Round Three using Genesys procedures, some area code designations had changed between rounds. Therefore, area codes for the overlap sample were updated before the Genesys identification procedure.

[10]The statuses include (1) working residential number; (2) nonresidential number; and (3) nonworking number (if, rather than being answered, an intercept message is heard).

The telephone numbers in each RDD sample release in Table II.4 were randomly sorted before being released, as Genesys samples are ordered by area code and exchange. The sample was then released to the CATI call scheduler; weekly survey reports on sample dispositions, by site, were used to determine the size of additional sample releases. We discuss the call scheduler and reports in Chapter IV.

E. FIELD SAMPLE SELECTION

The Household Survey included a field sample to provide coverage of people in households that did not have telephones or that had substantial interruptions in telephone service. Several studies have indicated that omitting nontelephone households might lead to biased survey estimates (Thornberry and Massey 1988; Marcus and Crane 1986; Corey and Freeman 1990). Strouse et al. (1997) found that telephone-only estimates would bias survey estimates for several demographic variables (particularly economic variables such as income), health insurance coverage, and some satisfaction measures. However, biases for most of these measures are small, because telephone coverage is high even across most vulnerable population groups; exceptions include Medicaid and Indian Health Service beneficiaries. First-round results from the CTS and the NSAF showed that a telephone-only approach could bias estimates for measures of health care utilization, insurance coverage, and economic status (Hall et al. 2000).

Because the field sample sites (the high-intensity sites) are a random sample of all the 48 large metropolitan sites in the sample, their inclusion reduced coverage bias for estimates made for the large metropolitan sites as a whole and for estimates made for each of the 12 high-intensity sites. This option was far less expensive than collecting data through field interviewing in all 60 sites. However, limiting the field sample to the 12 high-intensity sites meant that families and people who did not have telephones and who lived in nonmetropolitan areas or in metropolitan areas with populations of fewer than 200,000 were not represented. (In Chapter V,

we discuss weighting procedures to adjust for the absence of these households in national and other estimates.)

Within the 12 high-intensity sites, the strategy was to (1) sample geographic clusters with probability proportional to size, where size was the estimated number of nontelephone households; (2) count, list, and select housing units within these clusters; and (3) screen this sample for eligible households. Respondents in eligible households were then interviewed over cellular telephones provided by MPR field staff. Thus, all interviews were conducted by CATI, which prevented differential response resulting from different interviewing modes.

Selection of the field sample was similar for all four rounds of the Household Survey. The Round One report by Strouse et al. (1998) describes procedures for determining the Round One sample allocation among the 12 sites, identifying areas within the 12 sites for exclusion, establishing a measure of size for selecting clusters, stratifying clusters by county and by tract number within county, selecting clusters and listing areas, and listing addresses. Here, we discuss changes in Round Four procedures for defining field sample eligibility, allocating the sample among sites, and selecting addresses.

1. Defining Eligibility

In defining eligibility, the term *nontelephone household* means that the household was always or intermittently without landline telephone service. The field component was designed to include these households. In contrast, in the approach used by the decennial Census and the CPS, households were classified as telephone or nontelephone on the basis of the presence or absence of a telephone at the time of interview.[11]

[11]The 1990 Census estimates of prevalence of nontelephone households were based on a question on the "long form," asked of a large sample of decennial Census households. Question H12 asked, "Do you have a telephone in this house or apartment?" The 2000 Census asked if there is telephone service available in the unit, from which the household can both make and receive calls.

We originally had planned to use the Census definition as a screening criterion and to only interview households that did not have working telephones when a field interviewer first contacted them. However, based on experience in the RWJF Family Health Insurance Survey (Hall et al. 1994) and on research reported by Brick et al. (1995), we concluded that this static approach to defining telephone status would result in limitations for the CTS. The main limitation of the Census approach is its exclusion of households with substantial periods of interrupted telephone coverage that have telephone coverage at the time of the screening call. Although these households would have had a chance of being included in the telephone survey, we determined that they would have been underrepresented. Therefore, the field sample for all rounds of the Household Survey included households with a history of significant interruption in service.

In Round Four, as in prior rounds, we defined *significant interruption* to mean two weeks or more of interrupted service in the 12 months before the screening interview (or since the date the household moved into the area defined by our site, if the move occurred after we started data collection for the RDD sample) and used questions about the length of interruptions to adjust sample weights.[12] The only exception to the two-week rule was that households also were eligible for the field survey if members had moved to the listed address within the two weeks preceding the interview and had been without a telephone since moving in.

2. Allocation of the Sample Among the Sites

Table II.5 shows the field allocation model selected for the 12 high-intensity sites for Round One. The Round One allocation was based on considerations of cost, sampling error, and potential coverage bias (see Technical Report 15).

[12]We discuss the use of these questions in weighting in Chapter V.

TABLE II.5

TELEPHONE PENETRATION, ESTIMATED NUMBER OF NONTELEPHONE HOUSEHOLDS, AND ROUND ONE PRELIMINARY FIELD ALLOCATIONS

Telephone Penetration	Households Without Telephone[a] (Percent)	Nontelephone Households (Number)	Preliminary Field Allocation[b] (Number)
High Penetration			
Boston (MA)	1.9	30,456	21
Orange County (CA)	1.5	12,808	17
Seattle (WA)	2.0	15,298	22
Medium-High Penetration			
Cleveland (OH)	3.7	32,107	41
Lansing (MI)	3.2	5,078	36
Newark (NJ)	3.9	27,085	44
Syracuse (NY)	4.0	10,866	45
Medium-Low Penetration			
Indianapolis (IN)	5.0	26,340	56
Miami (FL)	5.0	34,652	56
Low Penetration			
Greenville (SC)	8.1	25,339	91
Little Rock (AR)	7.0	13,728	78
Phoenix (AZ)	6.2	52,656	69
Total	**—**	**—**	**576**

[a]Based on 1990 Census data, using Census definitions.

[b]Expected FIU interviews.

We reviewed our experience from Rounds One, Two, and Three and retained the third-round allocations for Round Four (see Technical Report 46). Table II.6 shows the Round Two, Three, and Four target allocations and completed interviews.[13] In some sites, the completed interviews were higher than the target number because of changes in the economy (resulting in more nontelephone households than found in the prior round) and the increase in the use of cellular telephones instead of landlines. They were lower than the target number in other sites due to many issues, including an increase in locked apartment buildings, changes in the economy resulting in higher landline telephone coverage, new construction taking away housing units, and increases in vacant housing units. In one site, our interviewer was required to obtain a peddler's license (a rule enacted after a door-to-door salesman committed a serious crime in the area).

3. Selecting Sample for Round Four

For Round Four, we contacted 5,129 addresses, all but 90 of which had been listed during previous rounds.[14] The initial release (in July 2003) included 4,154 addresses in all sites except Seattle. In September 2003, we first released addresses in Seattle. In October 2003, we released 424 additional addresses in sites that were most likely to fall short of their targets. Table II.4

[13]The targets were expressed in terms of households rather than FIUs because, in Round One we found that the number of FIUs per household varied substantially between sites.

[14]These 90 were "supplemental listings," housing units (as defined by the Census Bureau) in listed areas that had been missed in prior rounds or were perhaps newly constructed.

TABLE II.6

FIELD ALLOCATIONS AND FIELD COMPLETES FOR
ROUNDS TWO, THREE AND FOUR

	Household Interviews			
Site	Target Number of Households (Each Round)	Completed Round Two	Completed Round Three	Completed Round Four
Boston (MA)	9	5	21	9
Cleveland (OH)	36	55	46	44
Greenville (SC)	65	96	69	87
Indianapolis (IN)	70	74	97	90
Lansing (MI)	22	26	20	23
Little Rock (AR)	64	69	61	69
Miami (FL)	34	19	37	22
Newark (NJ)	48	53	80	72
Orange County (CA)	7	7	11	7
Phoenix (AR)	54	108	76	67
Seattle (WA)	49	15	47	11
Syracuse (NY)	42	35	30	18
Total	**500**	**562**	**595**	**519**

summarizes the sample release of the field component. We did not include new areas in the samples for Rounds Two through Four. We assumed that dwellings found in areas that had no chance of selection in Round One would most likely be housing constructed since Round One and that they would have a low likelihood of including households without telephones.

F. HOUSEHOLD, FIU, AND INDIVIDUAL SELECTION

1. Households

At the beginning of the interview, a household informant was identified and asked about the composition of the household. Typically, the household informant was the person who answered the telephone, if he or she was an adult age 18 or older. The person who owned or rented the house was identified as the head of the household, or the householder. People who usually lived in the household but who were temporarily living elsewhere, such as college students, were included in the household enumeration.

2. FIUs

The CATI program grouped people in the household into one or more FIUs. It did this to ensure that a knowledgeable informant would be able to answer questions about each family member's health insurance coverage, use of health resources in the 12 months preceding the interview, and usual source of health care. The FIU also provided information on family income and on the employment, earnings, health insurance plan, and race or ethnicity of each adult in the FIU. An FIU reflects family groupings typically used by insurance carriers and is similar to the filing unit used by Medicaid and state-subsidized insurance programs. The FIU includes an adult

household member, his or her spouse, if any, and any dependent children up to age 17, or 18 to 22 years of age if a full-time student (even if living outside the household).[15]

All FIUs were selected to participate in the rest of the interview as long as the FIU contained at least one civilian adult.[16] In each FIU, one informant was responsible for providing much of the information about the family and its members. Figure II.1 shows how one household of seven people could be divided into three FIUs. In this example, the household head's spouse is the household informant because the spouse answered the telephone and is familiar with the composition of the household. The spouse is also familiar with the health care of the head of household and their children, so the spouse is also the informant for the first FIU (FIU1). The household head's father is the informant for the second FIU (FIU2), and the unrelated boarder responds for himself or herself (FIU3). The household head's daughter is the randomly selected child in FIU1, and the head's son is not included in the survey. The use of separate FIU informants ensures that survey respondents provide information about the health experiences of family members usually covered under the same health insurance plan. The main exception is families in which spouses are covered under separate plans. Here, we allowed the FIU informant to answer for his or her spouse's plan.

[15]The CTS's definition of FIU differs from the Census Bureau's definition of a family, which includes all people living in the dwelling who are related to the householder by blood or by marriage. The Census family often is larger than an FIU. Adult relatives living in one household would be included in a Census primary family but would be assigned to separate FIUs for the CTS Household Survey.

[16]People who were not on active military duty at the time of the interview were considered to be civilians.

FIGURE II.1

EXAMPLE OF FAMILY INSURANCE UNITS (FIUs)
IN A HYPOTHETICAL HOUSEHOLD

Members of Household	FIU
Head of Household Head of Household's Spouse (Informant for HH and FIU 1) Head of Household's Daughter (Selected) Head of Household's Son (Not Selected)	FIU 1
Head of Household's Father (Informant for FIU 2) Head of Household's Mother	FIU 2
Unrelated Boarder	FIU 3

3. Individuals

The FIU informant answers questions about the FIU and about the health care situation and experiences of each adult FIU member and about one child (if the FIU included children). For FIUs containing more than one child, one was randomly selected.[17] (A "child" was defined as an unmarried individual younger than 18.) Full-time students age 18 or older were treated as adults in the survey; that is, they were asked all the questions asked of adults and could not be the randomly selected child.

Each adult in the FIU (not just the informant) was also asked to self-respond to questions about the difficulty obtaining needed medical services, health status, chronic diseases, tobacco

[17]Selection in Rounds Two through Four was random within an FIU if the FIU contained no children interviewed in the previous round. If an FIU contained one child for whom data were collected in the previous round, that child was selected for the current round. In the rare case in which a current-round FIU included two or more children who had been selected in different FIUs in that household in the previous round, we randomly selected one of those children. For example, assume a Round Three household included two FIUs, each with a child. Suppose one FIU included a grandmother and grandchild (10 years old), and the second the grandmother's daughter (22 years old) and her child (4 years old). Assume that the grandmother and both grandchildren are still in the household for the Round Four interview, but that the 22-year-old daughter has left. Then, there would be one Round Four FIU with two children who had been selected in Round Three. The Round Four procedure would be to randomly pick one of the children.

use, details about his or her last physician visit, and satisfaction with features of health care and health plans. We describe these questions in Chapter III.

4. Individuals Excluded from the Survey

The CATI survey instrument imposed a maximum of eight people per household for inclusion in the survey. The household informant identified all members of the household; in the rare instance of a household with more than eight people, interviewers were instructed to first list all the adults in the household, then list as many children as possible up to the maximum.

Some household members were classified as ineligible and were not included on the file. To avoid giving unmarried full-time college students multiple chances of selection, they were excluded from sampled dwellings in which their parents did not reside. Unmarried children younger than age 18 with no parent or guardian in the household also were excluded. Adults on active military duty were classified as ineligible; however, they could have acted as an FIU informant if there was at least one civilian adult in the family. FIUs in which all adults were active-duty military personnel were considered ineligible for the survey.

Some FIUs (those listed by, but not including, the household informant) did not respond to the interview. Nonresponding FIUs were excluded from the file but were statistically represented by responding FIUs in the weighting process. A few people had high levels of nonresponse to individual survey questions; consequently, they were considered to be nonrespondents and were excluded from the file. For Round Four, four people were excluded for this reason. Adult family members who did not respond to the self-response module were included on the file if the core interview contained responses for them.

III. SURVEY DESIGN AND PREPARATION

A. OVERVIEW

The CTS Household Survey is the primary instrument for assessing the effects of health system change on individuals, including changes in health insurance coverage, access to care, use of health services, and satisfaction with health care. As described in Chapter II, the FIU is the primary interviewing unit for the survey, with selected subjective questions also asked of each adult FIU member. Within each FIU, questions are asked about all adults and about one randomly selected child. An adult familiar with the health care experiences of the people in the FIU is the informant for other adults on questions about health insurance, employment, demographics, and health services use during the 12 months preceding the survey. Each adult in the FIU (including the informant) also is asked to self-respond to questions about difficulty obtaining needed health services, health status, chronic diseases, tobacco use, details about his or her last physician visit, level of satisfaction with that visit, satisfaction with health plan features, level of physician trust, consumer preferences, attitudes toward risk, and consumer information about health. The adult who took the randomly selected child to the last physician visit before the survey was asked questions about that visit, the child's health status, and any chronic disease the child had.

The length of the interview varied with the number of people in the FIU and the complexity of their experiences with health care. The Round Four core interview, which is asked of the family informant, averaged 31.4 minutes, and the self-response module averaged 20.1 minutes. This was about two minutes longer for the core interview, and one minute longer for the self-response module, than in Round Three.

B. INSTRUMENTATION

1. Household Survey

The survey instruments for all four rounds were developed by staff at HSC and MPR, with consultation and review by several experts.[1] Respondents to the Round Four survey were questioned about the following topics:

- Household composition
- Health insurance coverage, including prescription drugs
- Premium (nongroup) and premium contribution (employer-sponsored insurance) costs
- Use of health services
- Reasons for emergency room use
- Unmet needs and expenses
- Usual source of care
- Knowledge and use of the safety net by the uninsured
- Patient trust and satisfaction
- Plan satisfaction
- Last visit to a physician or other health care provider
- Language barriers with providers
- Health status and overall satisfaction with life
- Presence of chronic diseases
- Risk behaviors and smoking
- Employment, earnings, and income
- Demographic characteristics, including immigration status

[1]See Chapter III in Technical Publications 15, 34, and 46, respectively, for a discussion of the initial instrument design and changes made for prior rounds.

For the Round Four survey, we made substantial additions to the survey questionnaire, primarily to enhance access, insurance coverage, and cost analyses, which are of considerable policy importance (see Table III.1). We dropped the following questions that had been included on prior rounds: questions on preventive care (mammogram and flu shot), selected questions in the smoking cessation and consumer information sequences, and most of the SF-12® survey questions (keeping those used as stand-alone variables). We also substituted the Children with Special Health Care Needs (CSHCN) screener for the chronic conditions questions asked about children in prior rounds.[2]

For Round Four, we obtained information on insurance plans and products with the help of a database that MPR developed from InterStudy's HMO and PPO directories, the National Association of Insurance Commissioners' database of plans, a Judy Diamond Associates list of third-party administrators (TPAs), and PPO networks obtained from HSC site visits.[3] The de-duplicated database contains lists of insurers and TPAs and insurance products offered in the 60 CTS sites. This database served as a recall aid during the CTS interview to help interviewers and household respondents identify private health insurance plans that cover members of the household. Information on plan and product characteristics obtained from other data sources will be linked to the survey data.

[2]The CSHCN Screener is a brief module to identify children with chronic health conditions and is now widely used in national surveys, including the Medical Expenditure Panel Survey (MEPS), DoD Military Health System Beneficiary Survey, and CAHPS® Child Survey (see Bethell et al. 2002 and Van Dyck 2002). More information about the CSHCN screener is available at www.facct.org/cahmiweb/chronic/Screener/lwiscreen.htm.

Questions scsn1-scsn5 came directly from the CSHCN Screener, and question scsn5b is a slight rewording of screener question 5a.

[3]See Technical Publication 53 on HSC's website for more information and citations.

TABLE III. 1

SUMMARY OF NEW QUESTIONS FOR THE ROUND FOUR HOUSEHOLD SURVEY

Topics (Subsample)	Policy Value
Reasons for emergency room use	Classifying types of visits and decision processes that result in an ER visit will address whether system-level changes are leading to changes in use.
Consequences of unmet need	A followup to the existing questions on perceived unmet need to anchor questions in a recent health problem and to determine whether the patient obtained needed physician care, tests, and procedures. Also, questions on problems paying medical bills and the cost of a physician office visit for the uninsured.
Baker symptom response module[a] (subsample includes all uninsured and Medicare beneficiaries and a random sample of 1/6 of insured adults <65)	Based on self-report of selected clinical conditions for which there is consensus about treatment, questions are asked about whether the individual received care or faced unmet need and the consequences of unmet need on usual activities.
Knowledge and use of the health care safety net (uninsured)	Unknown how many uninsured actually use safety net providers or are aware of them. Helpful to know if many low-income uninsured do not use them, are not aware of them, or do not believe services they provide are of use to them.
Coverage of prescription medications and whether higher premiums are charged to cover preexisting conditions (individually insured)	Important because of controversy about how much coverage nongroup policies provide.
Perceived access to Medicaid and related state programs (uninsured)	Do people who are uninsured believe they can obtain public insurance coverage if they get sick?
Perceived difference in premiums offered to spouses (dual wage earner families)	Permits analysis of health plan choice in two-worker families.
Premium contributions (individuals with employer-sponsored insurance)	A key variable for take-up analyses.
Immigration status	Useful for identifying eligibility for public insurance.
Language barriers with providers	Patient provider interaction questions permit analysis of communications problems for the foreign-born.
Revised race question	Revised to be comparable to new Census measure for post-stratification.
Consumer attitudes about medical care	Items can be used to strengthen analyses of demand for insurance, unmet needs, access to care, and utilization of medical care. In particular, prior research has shown that there is variation in attitudes about medical care across racial and ethnic groups.
CSHCN screener to identify children with chronic conditions (children)	Provides a valid tool to identify children's chronic conditions for analyses on access, insurance coverage and health care experiences.
BMI measures	Provides platform to analyze relationship of BMI to other health status and health services measures.
Revised health-plan questions (privately insured)	Revised to allow access to an updated insurer database that will increase the ability to identify a family's health plan and product.

[a]Baker, David W., Martin F. Shapiro, Claudia L. Schur. "Health Insurance and Access to Care for Symptomatic Conditions." *Arch Intern Med.* 2000; 160:1269-1274. vol. 160, no 9, May 8, 2000.

New questions were cognitively tested by a survey researcher at The Gallup Organization.[4] MPR pretested the instrument to evaluate skip patterns, interviewer comprehension, and respondent burden. Table III.2 summarizes the content of the Round Four instrument (organized by topic); the sections of the interview in which these questions were asked are noted in parentheses. Appendix A contains an English version of the Round Four instrument; the Spanish version is available from HSC upon request.

Different respondents were asked different questions, and not all questions were asked of all respondents (see Table III.3). For example, only the household informant was asked about household composition. Family informants were asked to answer questions about the family and individual family members. Each adult also provided information on topics that the informant could not provide, such as unmet need for medical care, patient trust, satisfaction, health status, chronic diseases, and risk behaviors. If the family had children younger than age 18, the adult who took the sampled child to the doctor on her or his last visit was asked to answer questions about that visit.

2. Modifications for In-Person Component

Most of the CTS Household Survey interviews were obtained from the RDD sampling frame. As described above, we used an area probability sample in the 12 high-intensity sites to conduct additional interviews with FIUs in households with intermittent or no telephone coverage. Households in the area probability sample were administered a screening interview to identify eligible households, which were then interviewed by cellular telephone (see Appendix

[4]The report on cognitive interviewing is available from the HSC.

TABLE III.2

CONTENT OF THE ROUND FOUR HOUSEHOLD SURVEY

Health Insurance	
Private insurance coverage (Section B)	Covered by employer- or union-related private insurance Covered by other private insurance: Purchased directly Premium for directly purchased private insurance Premium contribution for employer-sponsored insurance Prescription drug coverage Whether higher premiums for preexisting conditions Provided by someone not in household
Perceived differences in premiums offered to spouses in dual wage earner families (Section F)	*Whether current plan costs more than employer-offered plan*[a] *Whether premium is about the same as employer-offered plan*[a] *Whether change to employer plan would cost more less, or the same for doctor visits or prescriptions*[a]
Public insurance coverage (Section B)	Covered by Medicare Covered by both Medicare and supplemental private insurance Premium for supplemental private insurance Covered by both Medicare and Medicaid Covered by Medicaid Covered by other public insurance (military, Indian Health Service, other state and local)
Uninsured (Section B)	Not covered by public or private insurance *Perceived Access to Medicaid and Related State Programs*
Continuity of coverage/changes in coverage (Section B)	Currently insured; lost coverage during previous 12 months Currently uninsured; obtained coverage during previous 12 months Uninsured during all of previous 12 months Uninsured at some point during previous 12 months Reasons for losing health insurance coverage Any type of change in health coverage: Changed private insurance plans Reasons for changing private plans Whether previous plan was HMO/non-HMO Changed from public or private plans Obtained or lost coverage
Insurance plan attributes (Section B)	Whether plan requires signing up with primary care physician or clinic for routine care Whether plan requires approval or referral to see a specialist Whether plan requires choosing a physician or clinic from a book, directory, or list Whether plan is an HMO Whether plan will pay any costs for out-of-network care
Other insurance variables (Section B)	Ever enrolled in an HMO Total number of years enrolled in an HMO

TABLE III.2 *(continued)*

Access to Health Care	
Usual source of care (Section D)	Currently has/does not have a usual source of care Type of place of usual source of care Type of professional seen at usual source of care Reason for changing usual source of care
Knowledge and Use of the Safety Net (Section D)	*Whether usual source of care offers reduced fees* *Whether a safety net provider in the area* *Safety net provider's practice setting* *Travel time to safety net* *Safety net provider visit in the last 12 months* *Reason for not using safety net provider*
Travel/waiting time for physician visit (Section E)	Lag time between making appointment and seeing physician at last physician visit[a] Travel time to physician's office for last visit[a] Time spent in waiting room before seeing medical person at last physician visit[a]
Difficulty getting needed services in previous year (Section C)	Did not receive needed services[a] Delay in receiving needed services[a] Reasons for delay or for not receiving needed services[a] *Most recent health problem for which (didn't get/delayed) medical care*[a] *Doctor visit during last 12 month for this problem*[a] *Doctor visit put off or delayed*[a] *Referred to a specialist during last 12 months for this problem*[a] *Specialist visit put off or delayed*[a] *Medical test to treat problem during last 12 months*[a] *Medical treatment put off or delayed*[a] *Procedure or surgery for problem during last 12 months*[a] *Procedure or surgery put off or delayed*[a] *Did not get needed prescriptions*[a] *Problems paying for services during last 12 months* *Contacted by collection agency, problems paying for necessities, put of purchases, used savings, had to borrow*
Baker symptom response module (subsample includes all uninsured and Medicare beneficiaries and a random sample of one-sixth of insured adults less than 65 (Section E)[c]	*Presence of symptoms, including back or neck pain, shortness of breath, blurry vision, loss of consciousness, frequent or severe headaches, cough with yellow sputum, depression, anxiety, pain in hip, knee or leg, sprained ankle, general fatigue, lump or mass in breast, difficulty urinating difficulty hearing, chest pain in the last three months*[a] *Whether person has seen a doctor*[a] *When a person contacted the doctor*[a] *Whether usual activities were limited*[a] *Whether person missed days of work*[a] *Whether person had paid sick leave*[a]

TABLE III.2 *(continued)*

Resource Use	
Use of ambulatory services in previous 12 months (Section C)	Number of physician visits Number of emergency room visits *Last ER vist* *Type of health problem* *Contact a doctor about problem* *Referred to ER by doctor* *Attempted to see doctor prior to ER visit* *Other places available to treat problem* *Type of other place* *Why go to ER instead of other place* Number of visits to nonphysician providers (nurse practitioner, physician assistant, midwife) Whether had any mental health visits Number of surgical procedures
Use of inpatient services in previous 12 months (Section C)	Number of overnight hospital stays Number of overnight hospital stays excluding delivery/birth Number of inpatient surgical procedures Total number of nights spent in hospital
Nature of last physician visit (Section E)	Reason for last visit: Illness or injury[a] Checkup, physical exam, other preventive care[a] Type of physician seen at last visit (PCP or specialist)[a] Whether last visit was to usual source of care[a] Whether last visit was to an emergency room[a] Whether last visit was with appointment or walk-in[a]
Costs (Section C)	Total family out-of-pocket expenses for health care during previous 12 months *Cost for doctor visit if uninsured* *How service was paid for*
Satisfaction and Patient Trust	
General satisfaction (Section E)	Overall satisfaction with health care received by family Satisfaction with choice of primary care physicians[a] Satisfaction with choice of specialists[a]
Satisfaction with last physician visit (Section E)	Satisfaction with thoroughness and carefulness of exam[a] Satisfaction with how well physician listened[a] Satisfaction with how well physician explained things[a] *Language barriers with providers (CAHPS)*[a]

TABLE III.2 *(continued)*

Satisfaction with health plan (Section E)	Satisfaction with referrals (CAHPS)[a] Satisfaction with health plan approvals (CAHPS)[a] Satisfaction with paperwork (CAHPS)[a] Satisfaction with amount paid for health care (NHIS) [a] Overall plan satisfaction (CAHPS)[a] *Approval needed for any care, tests, or treatments (CAHPS)*[a] *Delays in health care while waiting for approval (CAHPS)*[a] *Fill out paperwork (CAHPS)*[a] *Problems with paperwork (CAHPS)*[a]
Patient's trust in physicians (Section D)	Agree/disagree that physician may not refer to specialist when needed[a] Agree/disagree that physician may perform unnecessary tests or procedures Agree/disagree that physician is influenced by health insurance company rules[a] Agree/disagree that physician puts patient's medical needs above all other considerations[a]
Consumer attitude about medical care (Section D)	*Agree/disagree that person will visit doctor at the first sign of illness*[a] *Agree/disagree that person will do anything to avoid a doctor visit* [a]
Employment and Earnings	
Employment status and characteristics (Section F)	Whether adult respondent has the following characteristics: Owned a business or farm Worked for pay or profit during previous week Had more than one job or business Worked for private company/government/self-employed/family business Average hours worked per week, at primary job and at other jobs Size of firm (number employees), at site where respondent works, and at all sites Type of industry
Earnings (Section F)	Earnings from primary job and from all jobs
Health insurance options at place of employment (Sections B and F)	Whether eligible for health insurance coverage by employer Reasons for ineligibility Whether offered health insurance coverage by employer Reasons for declining coverage (if eligible but not covered) Whether offered multiple plans Whether offered HMO plan Whether offered non-HMO plan
Other Variables	
Demographics (Section A)	Age Gender Highest education level completed Whether interview was administered in Spanish CTS site State County[b]

TABLE III.2 *(continued)*

Health status (Section E)	Overall health status (five-point scale, from excellent to poor)[a] How much time calm and peaceful[a] How much time downhearted/blue[a]
Global satisfaction (Section E)	Taken altogether, how would you say things are these days? Would you say that you are very happy, pretty happy, or not too happy? (General Social Survey)[a]
Chronic conditions (Section E)	Presence of chronic conditions, including recent childbirth, abnormal uterine bleeding, diabetes, arthritis, asthma, pulmonary disease, hypertension, coronary heart diseases, skin cancer, other cancers, *benign prostate disease or enlarged prostate*, depression, other health problem limiting normal activities[a, b]
CHSCN screener to identify children with chronic conditions (replaces child's chronic condition questions) (Section E)[d]	*Whether child needs or uses medicine prescribed by a doctor, needs or uses medical care or mental or educational services, is limited or prevented doing things most children can do, needs or gets special therapies* *Is this a result of a medical, behavioral or other health conditions* *Has the condition lasted, or is it expected to last, for at least 12 months*
Family income (Section G)	Family income Race, ethnicity (revised to be consistent with 2000 Census)
Consumer preferences (Section B)	Whether person would be willing to accept limited provider choice To save on out-of-pocket expenses[a]
Risk behaviors (Section E)	Whether person agrees that he/she is more likely to take risks than the average person[a] *Whether person has smoked at least 100 cigarettes in lifetime*[a] *Whether currently smoking cigarettes every day, some days, or not at all*[a]
Body Mass Index (BMI)	*Weight without shoes*[a,e] *Height without shoes*[a,e]

Note: New or changed questions shown in italics.

[a]Information was obtained from the self-response module.

[b]Available on the Restricted Use File only.

[c]Baker, David W., Martin F. Shapiro, Claudia L. Schur. "Health Insurance and Access to Care for Symptomatic Conditions." *Arch Intern Med.* 2000; 160:1269-1274. vol. 160, no 9, May 8, 2000.

[d]The CSHCN Screener is a brief module to identify children with chronic health conditions and is now widely used in national surveys, including the Medical Expenditure Panel Survey (MEPS), DoD Military Health System Beneficiary Survey, and CAHPS® Child Survey (see Bethell et al. 2002 and Van Dyck 2002). More information about the CSHCN screener is available at www.facct.org/cahmiweb/chronic/Screener/lwiscreen.htm.

[e]While BMI is available on the PUF and RUF, height and weight are not.

TABLE III.3

SOURCE OF DATA FOR INDIVIDUALS IN THE ROUND FOUR HOUSEHOLD SURVEY, BY QUESTION TOPIC

Family Insurance Unit Member	Household Composition (Sec. A)	Insurance Coverage (Sec. B)	Service Use/ Expenses and Bills (Sec. C)	Unmet Needs (Sec. C)	Usual Source of Care/ Affordable Medical Care (Sec. D)	Patient Trust and Attitudes (Sec. D)	Satisfaction with Health Care and Health Plan (Sec. E)	Last Doctor Visit (Sec. E)	General Health Status (Sec. E)	Specific Health Status Information (Sec. E)	Risk/ Smoking/ Height and Weight (Sec. E)	Employ-ment/ Earnings/ Employer Plans (Sec. F)	Family Income (Sec. G)	Ethnicity/ Race/ Citizen-ship (Sec. G)
First Family Insurance Unit														
Family Informant	**H**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**
Spouse	**H**	**F1**	**F1**	**SRM**	**F1**	**SRM**	**SRM**	**SRM**	**F1 and SRM**	**SRM**	**SRM**	**F1**	**F1**	**F1**
Randomly Selected Child	**H**	**F1**	**F1**	**F1**	**F1**	**Not Asked**	**F1**	**FC**	**FC or F1**	**FC or F1**	**Not Asked**	**Not Asked**	**F1**	**Not Asked**
Other Children	**H**	Data not available – Not randomly selected child.												
Second Family Insurance Unit														
Family Informant	**H**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**	**F2**
Spouse	**H**	**F2**	**F2**	**SRM**	**F2**	**SRM**	**SRM**	**SRM**	**F2 and SRM**	**SRM**	**SRM**	**F2**	**F2**	**F2**
Third Family Insurance Unit														
Unrelated Adult	**H**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**	**F3**

Notes:

H	Data provided by the household informant (typically person who answers the telephone, if adult).
Fi	Data provided by family informant for family insurance unit "i".
SRM	Data provided by the individual adult family member via the Self-Response Module questions.
Fi and SRM	Data on general health status provided by the family informant and each individual adult family member via the Self-Response Module. In constructing the variable GENHLH, the SRM response was used when available. Otherwise, the family informant's response was used.
FC	Data provided by adult who took randomly selected child to last doctor visit. Skip questions if that adult not in family.
FC or Fi	Data provided by adult who took randomly selected child to last doctor visit. Use family informant if that adult not in family.

A). For the purposes of methodological research,[5] we added three questions to the screener interview in Round Four about cellular telephone use in these households:

1. Does anyone in this household have a working cellular telephone?
2. IF YES: How many people living here have a cellular telephone?
3. [Do any of these people]/[Does this person] receive calls on their cellular telephone more than once or twice a month?

We also modified the CATI instrument slightly for field administration. Because of the high cost of making return visits to these households, we tried to obtain proxy information about all household members from one family informant when an informant for a secondary FIU was not home at the time of the primary FIU interview, rather than insisting on a separate informant for each FIU, as was done for the RDD sample. However, the field interviewer tried to obtain answers to self-response modules from each adult in the household.

C. ADVANCE MATERIALS, SURVEY INTRODUCTION, AND INCENTIVES

Notifying potential respondents to a telephone survey by mail before an initial call is made can reassure them about a survey's authenticity and purpose. The general public's willingness to participate in a survey may also be increased by obtaining sponsorship or endorsement from a well-known public organization (usually a government agency) and by designing a convincing survey introduction that describes the survey's purpose and value. Monetary incentives also can be effective in increasing response rates and retaining participants in a longitudinal survey. For Rounds One and Two, we tested the content of the survey introduction, the effectiveness of advance information about the study, and the amount and form of monetary incentives (see

[5]Responses to these questions could also have been used to improve the efficiency of the field sample design in future rounds of the CTS.

Technical Publications 15 and 34 on HSC's website). Based on findings from these rounds of the survey, we standardized advance letters (see Appendix B), the text of the survey introduction, and incentives.

1. Advance Letters

As in prior rounds, we mailed an advance letter to the addresses of households in the overlap sample that completed interviews in Round Three. We also mailed letters to households with published addresses that were part of the overlap sample and did not complete interviews (both refusals and noncontacts) or whose telephone numbers had not been selected before.

2. Survey Introduction

We used different survey introductions for (1) overlap complete households, (2) other households with published addresses, and (3) households for whom we did not have published addresses. A separate introduction also was used for the field sample (see Appendix B). The survey introductions were similar to those used in Rounds Two and Three, briefly mentioning the survey's purpose, prior contact (for overlap complete sample), the advance letter (if one was mailed), and the promised incentive. We gave interviewers additional text to answer respondents' questions. This text included an explanation of why health tracking is important, examples of the types of questions included in the survey, a contact at RWJF to verify the survey's authenticity, and additional background on sponsorship, interview length, and respondent selection. Based on prior experience and experiments, we concluded that a brief introduction with flexible responses to respondents' questions was more effective than a lengthy one.

3. Incentives

For Round Three, each adult was offered $25, in part because a large number of CTS respondents were sampled for other surveys for which they were offered $25, and in part because of the increased length of the self-response module, which was asked of each adult.[6] We continued to offer $25 to each adult participating in Round Four. For Round Three and Round Four, the self-response module was more than half the length of the core interview, so non-informant adults responding to the survey were likely to expect comparable compensation. Since a large fraction of the Round Four sample was selected from Round Three participants, we believed that the investment in incentives was justified to obtain a high cooperation rate from all adults in sampled families.

Sampled respondents were promised incentives with their initial letter and call. However, near the end of data collection, rather than promising checks for responding, we mailed checks in the amount of $25 to people (for whom we had names and addresses) in households that had not yet responded. These included respondents to the Round Three survey whose households were selected for Round Four, as well as part of the sample interviewed for the first time for whom we also had complete names and addresses. Experience in Rounds Two and Three demonstrated that shifting from promised to prepaid incentives resulted in faster responses and slightly higher cooperation rates than continuing with promised incentives. On the other hand, this procedure was costly, since some nonrespondents cashed checks. We describe the results of this effort in Chapter IV.

[6]Many Round Three CTS sample members were selected for the RAND Community Quality Index Survey and for the UCLA/RAND Health Care for Communities Survey.

D. INTERVIEWER SELECTION AND TRAINING

1. RDD Sample

a. Recruitment

Interviewing for the RDD sample was conducted by MPR in its Columbia, Maryland, and Princeton, New Jersey, survey operations centers. Altogether, 192 telephone interviewers were trained for the Round Four household survey. Interviewing supervisors received a detailed manual with additional information enabling them to respond to interviewers' questions and resolve routine problems. Interviewers received a question-by-question review of the survey, approaches to contacting respondents, disposition coding, summary of the interviewer bonus plan, and follow-up training on interviewing problems and refusal avoidance.

b. Telephone Interviewer Training Program

New interviewers were given MPR's standard general interviewer training program, which lasted 12 hours and was conducted in three 4-hour sessions. Topics included obtaining cooperation, understanding bias, using probing methods, using the CATI system, and resolving administrative issues. A variety of media and methods were used in training, including a videotape on the role of the interviewer, discussion on ways to avoid bias, role-playing, and written exercises.

Training on the survey instrument lasted 12 hours, with up to 8 hours of additional practice sessions, if necessary. The training session covered the following topics:

- An introduction to the project and sample design (see Chapter II of the *Training Manual*)
- A review of the CATI instrument (see Chapter III of the *Training Manual*)
- Question-by-question review of the instrument presented on a video screen

- Review of contact procedures, advance materials, methods for gaining cooperation, and appropriate responses to respondents' questions (see Chapter VI of the *Training Manual*)
- Hands-on practice with scripted mock interviews (see Chapter VII of the *Training Manual*)
- Exercises to test respondents' skills in obtaining cooperation (see Chapter VIII of the *Training Manual*)
- Review of disposition coding and call scheduling (see Chapter IX of the *Training Manual*)
- Hands-on practice with actual respondents selected from telephone numbers that were not sampled for Round Four

Because most of the interviewers in Round Four had worked on prior rounds of the CTS, the training described above occurred in prior rounds. A refresher training was conducted in Round Four, with a training guide highlighting changes to the survey instrument and procedures for the new round. A copy of the training manual can be found in an appendix to the Round Three Methodology Report (Technical Publication 46 on HSC's website). Appendix C of this report contains the training guide for Round Four.

Because initial refusal rates for all rounds of the survey were high, considerable effort was devoted to preparing interviewers for placing calls to reluctant respondents. A key component in this effort was the use of a practice training account. Telephone numbers in the training account consisted of Round Three telephone numbers that were not sampled for Round Four. Practicing actual interviews gave the interviewers an opportunity to interact with reluctant respondents and to become more proficient in responding to questions and concerns before interviewing households sampled for Round Four.

Supervisors reinforced training techniques throughout the survey by monitoring calls and providing regular feedback; approximately 10 percent of the interviews were monitored. In addition, we conducted refusal conversion training sessions, during which trainers reviewed

effective approaches and interviewers shared experiences about the success or failure of various techniques. A successful interviewer bonus plan was initiated three months after the interviewing started as an additional incentive to address high refusal rates. Interviewers were given points for completing interviews based on difficulty in gaining cooperation, and the points were converted to bonuses on a weekly basis.

2. Field Sample

a. Recruitment

Thirteen MPR staff members, 11 of whom worked on the Round Three survey, were trained to screen households in the 12 high-intensity sites. In addition, two people who had worked for MPR in other field studies were hired for the Boston, Massachusetts, and Seattle, Washington, sites. We did not list any new segments for Round Four; however, interviewers were responsible for listing new dwellings within existing segments (described as supplemental listing; see Chapter II).

b. Training

For the 11 returning trainees who had participated in Round Three, the training session was limited to a review of data collection procedures. Training was conducted during a two-hour conference call in which the MPR trainer reviewed screening procedures with trainees. The training call included a discussion of the survey introduction, refusal avoidance, the telephone status screener, operation of the cellular telephone, and follow-up interviewing methods (such as attempting contacts at varying times of the day and gaining entry to apartment buildings). The two new trainees received additional background on data collection methods via conference call, including procedures to list new housing units identified during fieldwork. After completing the training program, each trainee called the MPR telephone center and conducted a practice

screening interview with a supervisor. Appendix D contains the manual provided to field listers and screening interviewers. Because field staff called the MPR telephone center and then gave the respondent a cellular telephone to complete the interview, they did not have to be trained on how to conduct the survey.

E. CATI SYSTEM

All data collected for the CTS Household Survey were produced using computer programs made available through the Computer-Assisted Survey Methods Program (CSM), University of California, Berkeley.[7]

MPR used the CASES program to develop instruments and data cleaning programs for the CTS. In addition, we developed customized programs for allocating the sample and for controlling the distribution and timing of calls and developed specialized reports for monitoring the survey results (discussed in Chapter IV).

[7]Neither the CSM staff nor the University of California bear any responsibility for the results or conclusions presented here.

IV. DATA COLLECTION

A. OVERVIEW

For Round Four, we interviewed 25,419 family insurance units (FIUs)—24,613 from the RDD sample and 806 from the field sample. The FIUs included 39,260 eligible adults and 7,327 sampled children younger than age 18, for a total of 46,587 people (see Table IV.1). The unweighted Round Four household-level response rate was 66.5 percent, and the unweighted FIU-level response rate was 62.7 percent. The weighted response rates for Round Four were 59.9 percent (household level) and 56.5 percent (FIU level).

In this chapter, we describe the RDD and field data collection efforts and changes from prior rounds, including (1) response rate calculations and patterns; (2) efforts to reduce nonresponse, including call-scheduling procedures; (3) use of Spanish-speaking interviewers, refusal conversions, monetary incentives, and selective use of proxy respondents; (4) quality assurance procedures; and (5) data editing and file preparation.

TABLE IV.1

NUMBER OF INTERVIEWS COMPLETED WITH FIUs AND PERSONS,
BY ROUND OF THE CTS HOUSEHOLD SURVEY
(Numbers)

	Round One	Round Two	Round Three	Round Four
Number of FIUs				
RDD	32,079	31,278	31,744	24,613
Field	635	769	925	806
Total	**32,732**	**32,047**	**32,669**	**25,419**
Number of Persons				
Adults	49,807	48,724	49,603	39,260
Children	10,639	10,232	10,122	7,327
Total	**60,446**	**58,956**	**59,725**	**46,587**

B. ORGANIZATION OF THE RDD AND FIELD SURVEYS

1. RDD Survey

Interviewing for the RDD sample was conducted from February 2003 to February 2004 in MPR's Princeton, New Jersey, and Columbia, Maryland, survey operations centers by 192 interviewers.

Reports on the progress of data collection were transmitted daily to the operations centers. The survey reports enabled project managers and interviewing supervisors to monitor production and performance continuously. Several reports were produced, including:

- ***Status Disposition reports.*** These showed daily and cumulative distributions of interim and final survey disposition codes (completions, various nonresponse and ineligibility dispositions, and current statuses for active cases), for the total sample; for each stratum; and for subgroups, including Spanish-speaking and refusal conversion samples.
- ***Site Status Disposition reports.*** These showed cumulative distributions of interim and final survey disposition codes, by site.
- ***Daily Interviewer Performance reports.*** These monitored last-day and cumulative performance statistics, including completions, separate self-response modules, first refusals, final refusals, number of calls, time per call, and time per completed interview.

These reports were supplemented by regularly scheduled weekly conference calls with survey supervisors and by visits to the survey operations centers by survey managers.

2. Field Survey

Thirteen MPR field interviewers, supervised by an MPR field supervisor in the Princeton office, screened addresses to identify households without telephone service or with interrupted telephone service. Reports were developed to monitor field costs and screening outcomes. Because interviews with eligible households were conducted via cellular telephone calls to MPR's Princeton telephone center, the CATI reports were used to monitor interview production

and sample dispositions, by site. Field interviewers reported weekly to the MPR field supervisor.

C. RESPONSE RATES

1. Calculation of Response Rates

Both unweighted and weighted response rates were calculated at the household and FIU levels for the RDD, field, and combined samples and for various subgroups, including sites and combinations of sites. The response rate is based on the standard definition the American Association for Public Opinion Research has proposed for surveys with unknown eligibility for some interviewing units (American Association for Public Opinion Research 2000):

(1) $RR=I/[(I + P) + (R + NC + O) + e(UH + UO)]$,

where:

- *RR = response rate*
- *I = complete interview*
- *P = partial interview (insufficient data for analysis)*
- *R = eligible refusal*
- *NC = eligible noncontact*
- *O = other eligible*
- *UH= unknown whether household or occupied household*
- *UO = unknown other*
- *e = estimated proportion of cases with unknown eligibility that are eligible*

The household-level response rate is the ratio of the number of households in which at least one FIU interview was completed to the estimated number of eligible households. This response rate is comparable to that used in many surveys, such as the CPS. We could not determine

residency for all sampled telephone numbers (RDD) and addresses (field). Using methods described below, we estimated the number of telephone numbers with undetermined residency that were residential. Because the survey was designed to represent the civilian noninstitutionalized population, some residences were not eligible for the survey. We also estimated survey eligibility for confirmed residential households for which the household demographic section was not completed.

The primary interviewing unit for the CTS Household Survey is the FIU, rather than the household. Consequently, we computed an FIU-level response rate that is the product of the household-level response rate and the percentage of eligible FIUs within completed households that responded.

The following sections describe how we calculated response rates for the RDD and field samples, as well as for the combination of the two samples. Table IV.2 shows the disposition of the RDD household sample, by sample type, Table IV.3 shows the disposition of the RDD sample at the FIU level, and Table IV.4 shows the final disposition of the field sample.

a. Determining Residency for the RDD Sample

When calculating a response rate, the denominator should reflect all eligible cases sampled. In many surveys, however, eligibility status is not determined for all cases and must be estimated. For RDD surveys, residency typically is not established for all sampled telephone numbers, even after many calls have been made. For example, some telephone numbers ring when dialed, even though the telephone number is not in use. Consequently, the first step in computing the RDD response rate was to estimate residency for sampled telephone numbers. Residency was determined for 89.0 percent of the 48,929 sampled telephone numbers (Table IV.2). Residency was not confirmed for the remaining sample, which included 6.0 percent ring, no answers; 0.1 percent mechanical answering devices or answering services; and 4.8 percent

TABLE IV.2

FINAL ROUND FOUR CTS HOUSEHOLD-LEVEL SURVEY DISPOSITION (RDD SAMPLE)
(Numbers)

		Round Three Complete	Round Three Hard Refusal	Round Three Other Nonresponse	Round Three Non-Household	Round Three No Answer	Round Three Mech. Ans. Dev.	Old Working Banks	New Working Banks	Total	Proportion
A. Complete											
1	A. Complete (all components)	12,220	134	153	497	55	1	4,151	130	17,341	.354
2	A. Core complete self-response missing	920	24	36	56	5	0	669	14	1,724	.035
3	A. Core Complete secondary FIU missing	831	19	27	62	6	1	456	13	1,415	.029
										20,480	.419
B., C. Residential Nonresponding Household											
22	B. Breakoff	164	4	17	35	4	1	175	3	403	.008
20	C. Hung up during introduction	147	146	64	61	9	1	337	9	774	.016
21	C. Household refusal	2,284	566	298	325	33	1	2,998	73	6,578	.134
30	C. Language barrier	51	3	19	12	1	0	123	2	211	.004
31	C. Illness barrier	48	2	5	2	1	0	37	1	96	.002
34	C. Maximum calls (residential)	452	2	10	18	7	1	66	3	559	.011
39	C. Other eligibility unknown	0	0	0	0	0	0	5	0	5	.000
66	C. Effort ended	1	4	0	0	2	0	9	0	16	.000
										8,642	.177
D., E. Ineligible[a]											
41	D. No eligible person in hhold	35	1	2	21	2	0	60	7	128	.003
48	D. Duplicate	0	0	0	1	0	0	2	0	3	.000
42	E. Computer/fax/ modem	187	9	25	428	184	0	1,267	67	2,167	.044

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TABLE IV.2 (*continued*)

		Round Three Complete	Round Three Hard Refusal	Round Three Other Nonresponse	Round Three Non-Household	Round Three No Answer	Round Three Mech. Ans. Dev.	Old Working Banks	New Working Banks	Total	Proportion
43	E. Disconnected, out of service	4,209	177	261	967	203	6	2,946	300	9,069	.185
44	E. Cell phone, pager	20	2	0	7	1	0	49	7	86	.002
45	E. Non-residence	533	23	52	737	63	0	1,470	118	2,996	.061
										14,449	.295
F1. Ring, No Answer/ Undetermined Residential											.060
65	F1. Ring, no answer	223	6	42	306	837	2	1,463	78	2,957	
F2. Mechanical Answering Device (MAD)											
64	F2. Answering service	6	0	0	0	0	0	2	1	9	.000
67	F2. Mechanical answering device	2	0	0	7	11	0	10	1	31	.001
										40	.001
F3. Contact/ Undetermined Residential											
36	F3. Maximum calls (probable residence)[b]	666	32	128	213	85	11	1,178	48	2,361	.048
Total		**22,999**	**1,154**	**1,139**	**3,755**	**1,509**	**25**	**17,473**	**875**	**48,929**	

[a]There were 17,590 telephone numbers classified as business or nonworking numbers by Genesys-ID-Plus, and never released for interviewing.

[b]Based on information provided during one or more calls, interviewer indicated that the telephone number is linked to a probable residence.

TABLE IV.3

FINAL ROUND FOUR CTS FIU-LEVEL SURVEY DISPOSITION (RDD SAMPLE)[A]
(Numbers)

	Round Three Complete	Round Three Hard Refusal	Round Three Other Non-Response	Round Three Non-Household	Round Three No Answer	Round Three Mech. Ans. Dev.	Old Working Banks	New Working Banks	Totals
A. Responding Eligible FIU	16,944	209	254	734	86	2	6,202	182	24,613
B. Nonresponding Eligible FIU	822	22	29	66	7	1	512	15	1,474
C. Ineligible FIU (no civilian adults)	154	0	5	15	0	0	64	3	241
Total	**17,920**	**231**	**288**	**815**	**93**	**3**	**6,778**	**200**	**26,328**

[a]These cases are limited to households in which at least one interview with an FIU was completed.

with some personal contact, but with no confirmation of residency after the maximum number of calls were made. In Round Three, we compared procedures commonly used to estimate residency for RDD surveys (see Appendix E of Technical Publication 46 on HSC's website). We evaluated the CASRO method (two variations),[1] the "business office" method, and the survival analysis method developed by Brick et al. (2002). The "business office" method (see Brick and Broene 1997; Shapiro et al. 1995; Brick et al. 1998) involves asking telephone companies to provide the residential status of all, or a sample of, unresolved telephone numbers, or using estimates from other studies. The former approach is problematic due to the lack of cooperation of telephone companies, the latter due to the age of data reported from other studies. The survival analysis method not only looks at whether the number is resolved as residential or

[1]CASRO stands for the Council of American Survey Research Organizations, and its special report, "On the Definition of Response Rates." L.R. Frankel, Chairman, "A Special Report of the CASRO Task Force on Completion Rates," June 1982. We refer to this method as CASRO, because one option in its recommendations is to apply the eligibility rate for cases with determined eligibility status to those with undetermined eligibility status.

TABLE IV.4

FINAL ROUND FOUR CTS HOUSEHOLD SURVEY DISPOSITION (FIELD SAMPLE)
(Numbers)

Disposition		Households
Complete		
1	Core complete—eligible[a]	476
2	Core complete—self-response missing	5
3	Core complete—secondary FIU missing	38
Eligible Nonresponse (Telephone Interruption)		
21	Refused survey screener	35
22	Breakoff during main interview	4
Ineligible Household		
40	No interruption in telephone service	3,012
41	Not selected (all military or children)	10
Household with Unknown Telephone Status Eligibility		
20	Refused telephone screener at doorstep	188
30	Language/other barrier	19
65	Effort ended—no contact	117
Not a Residential Household		
45	Not a residence	14
46	No housing unit	292
47	Vacant unit	573
Unknown Whether a Household		
67	Effort ended—locked building	346
Total		**5,129**

[a]For the field component, the household informant sometimes responded for all the FIUs in the household.

[b]The total number of housing units attempted is greater than the number of released (in Table II.4) because additional housing units were discovered during screening.

not (or left unresolved), but also models the time until resolution of a telephone number. The idea behind using this method is that the additional information about time until resolution should provide a more accurate estimate of the residency rate than simply using the final resolution status.

Carlson and Kasprzyk (2004) evaluated this method as part of a session at the 2004 Joint Statistical Meetings that focused on using call history data and the survival analysis method to estimate residency. After comparing the CASRO and survival analysis methods, we decided that the survival analysis method was too unstable in terms of the residency rates it generates for unresolved telephone numbers. The [unresolved] residency rates it generated varied significantly with slight changes in assumptions, while the CASRO residency rate and the overall residency rate from the survival analysis method both remained fairly stable under slightly different scenarios. The overall residency rate it generates was actually quite comparable to the comparable rate resulting from the CASRO method, likely due to the very large number of call attempts that we made in CTS before classifying a telephone number as unresolved. As a result, we decided to report response rates using the CASRO method for CTS in Rounds Three and Four.

b. Household Response Rate for the RDD Sample

To calculate an interview response rate at the household level, we first determined whether each telephone number was residential and then determined whether each household completed at least one FIU interview.

We classified each telephone number according to the disposition codes in Table IV.2:

a. At least one eligible responding FIU in the household—codes 1, 2, 3 (n = 20,480)

b. Eligible nonresponding household—code 22 (n = 403)

c. Nonresponding residential household, with insufficient information to determine whether there is an eligible FIU—codes 20, 21, 30, 31, 34, 39, 66 (n = 8,239)

d. Residential household, where all FIUs in the household are ineligible—codes 41, 48 (n = 131)

e. Telephone number was coded by the interviewer as nonresidential or nonworking—codes 42, 43, 44, 45 (n = 14,318) or screened out as nonresidential or nonworking by Genesys ID Plus, which excludes many business and

nonworking numbers before an interviewer calls the telephone number (n = 17,590)

f. Unable to determine whether telephone number was residential (n = 5,358)

- f1. Ring, no answer—code 65 (n = 2,957)
- f2. Mechanical answering device—codes 64, 67 (n = 40)
- f3. Maximum calls—code 36 (n = 2,361)

Within each site and sampling group *s*, we calculated a residency rate among telephone numbers with resolved residency status, and a survey eligibility rate among residential households with known survey eligibility:[2]

(3) $$RSDR_s = (A_s + B_s + C_s + D_s)/(A_s + B_s + C_s + D_s + E_s).$$

(4) $$SER_s = (A_s + B_s)/(A_s + B_s + D_s).$$

We then calculated within each site and sampling group the estimated number of eligible households as:

(5) $$HH_s = A_s + B_s + \left(C_s + \left(F_s \cdot RSDR_s\right)\right) \cdot SER_s.$$

Finally, we calculated a household response rate within each site, as follows:

(6) $$HRR_s = \frac{A_s}{HH_s}.$$

[2]Sampling group refers to the four overlap categories (complete; hard refusal or other nonresponse; nonhousehold; no answer or mechanical answering device), plus the two new sample categories (old working banks and new working banks).

To compute response rates involving more than one site or sampling group, we summed the number of completes and the estimated number of eligible households across sites or sampling groups, and divided the number of completes by the estimated number of eligible households.

Weighted response rates were calculated similarly, except that we used counts weighted by sampling weights, by which we mean the inverse of the probability of selection (including adjustments for site selection and for alternative probabilities of selection).

c. Household Response Rate for the Field Sample

To calculate a household response rate for the field component, we had to determine whether (1) each address was an occupied residence, (2) the residence met the criteria for interruption in telephone service, and (3) there was at least one survey-eligible person in the household. To estimate eligibility rates for addresses with undetermined eligibility, we applied rates from those with known eligibility status. First, we classified each address according to the disposition codes in Table IV.4:

a. Eligible responding household—codes 1, 2, 3 (n = 519)

b. Eligible nonresponding household—code 22 (n = 4)

c. Nontelephone household ineligible for survey—code 41 (n=10)

d. Nontelephone household with insufficient information to determine whether eligible for survey—code 21 (n = 35)

e. Ineligible household (no interruption in telephone service)—code 40 (n = 3,012)

f. Unable to determine telephone status of household—codes 20, 30, 65 (n=324)

g. Not a household or vacant—codes 45, 46, 47 (n = 879)

h. Unable to determine whether address was residential (locked building)—code 67 (n = 346)

Within each high-intensity site *s*, we calculated three eligibility rates: (1) a household eligibility rate (proportion of addresses known to be occupied residences), (2) a field component eligibility rate (proportion of residences known to have had telephone interruption), and (3) a survey eligibility rate (proportion of residences with telephone interruption known to be eligible for the survey):

(7) $$HER_s = (a_s + b_s + c_s + d_s + e_s + f_s)/(a_s + b_s + c_s + d_s + e_s + f_s + g_s).$$

(8) $$NER_s = (a_s + b_s + c_s + d_s)/(a_s + b_s + c_s + d_s + e_s).$$

(9) $$SER_s = (a_s + b_s)/(a_s + b_s + c_s).$$

Within each high-intensity site *s*, we calculated the estimated number of eligible households as:

(10) $$HH_s = a_s + b_s + \left(d_s + \left(f_s + \left(h_s \cdot HER_s\right)\right) \cdot NER_s\right) \cdot SER_s.$$

We then calculated a household response rate within each site as follows:

(11) $$HRR_s = \frac{A_s}{HH_s}.$$

To compute response rates involving more than one site, we summed the number of completes and the estimated number of eligible households across sites, and divided the number of completes by the estimated number of eligible households.

As with the RDD response rates, weighted response rates for the field component were calculated using counts weighted by sampling weights.

d. Combinations of Household Response Rates

When calculating a response rate for combinations of various sample components (such as the RDD sample and the field sample combined), we summed the number of completes and the estimated number of eligible households across sample components, and divided the number of completes by the estimated number of eligible households.

e. Family Interview Response Rate

To calculate an interview response rate at the FIU level, we began with all FIUs in responding households (that is, households with at least one eligible responding FIU). We classified each FIU in the RDD sample according to the categories in Table IV.3 as follows:

a. FIU is eligible for the survey and responded to interview (n = 24,613).

b. FIU is eligible for the survey but did not respond to interview (n = 1,474).

c. FIU is ineligible for survey (n = 241).

For the field component, the household informant was allowed to respond for each FIU, if necessary; consequently, the FIU response rate is approximately equal to the household response rate. Among the 868 FIUs in the responding field households, 806 were completes, 14 were coded as ineligible, and 48 were eligible nonresponding FIUs.

For each site and sampling group, we then calculated an FIU-level response rate conditioned on being in a household with at least one completed FIU interview:

$$(12) \qquad FRR_s = \frac{A_s}{A_s + B_s}.$$

The combined response rate (which we will call the *FIU response rate*) for site and sampling group *s* is the product of these two rates:

(13) $RR_s = HRR_s \cdot FRR_s$.

For any conditional FIU-level response rates involving more than one site or sampling group, we first summed the number of cases in categories A and B listed above (for example, $A = \sum_s A_s$, $B = \sum_s B_s$, if summing across the entire sample) and then calculated the conditional response rate.

(14) $FRR = \frac{A}{A + B}$.

The FIU response rate is the product of the two rates:

(15) $RR = HRR \cdot FRR$.

Weighted response rates at the FIU level were calculated similarly, except that we used counts weighted by sampling weights.

Conditional FIU response rates for the RDD and in-person components were calculated in the same way as the household response rates.

2. Patterns in Household and FIU Response Rates, by Sample Type

a. Response Rates, by Sample Type

Tables IV.5 and IV.6 show the unweighted and weighted household- and FIU-level response rates for the Round Four sample, by sample type. (Appendix E provides tables with additional response rate details for subgroups of the sample.) For the four Round Three overlap sample components, the unweighted and weighted response rates are similar to one another. When combining these components for the Round Three overlap sample as a whole, however, the weighted response rate is significantly lower than the weighted rate. This is because the Round

TABLE IV.5

ROUND FOUR CTS HOUSEHOLD-LEVEL RESPONSE RATE, BY SAMPLE TYPE
(Percents)

	Unweighted	Weighted
RDD		
Round Three Overlap Sample		
Completed interviews	78.49	79.16
Hard refusal or other Nonresponse	23.61	23.16
No answer or Mechanical answering device	30.01	29.84
Not a household	53.30	53.30
Total Round Three Overlap Sample	72.18	63.69
New Sample		
Old working banks[a]	53.69	48.06
New working banks[b]	61.69	61.31
Total New Sample	53.89	48.70
Total RDD	66.22	59.12
Field	77.86	77.45
Total Sample	**66.47**	**59.88**

[a]Working banks in existence at the time the Round Three sample was selected.

[b]Working banks that were added between the end of Round Three and the beginning of Round Four.

TABLE IV.6

ROUND FOUR CTS FIU-LEVEL RESPONSE RATE, BY SAMPLE TYPE[a]
(Percents)

	Unweighted	Weighted
RDD		
Round Three Overlap Sample		
Completed interviews	74.85	75.73
Hard refusal or other nonresponse	21.27	20.96
No answer or mechanical answering device	27.51	27.58
Not a household	48.91	48.91
Total Round Three Overlap Sample	68.62	60.44
New Sample		
Old working banks[b]	49.59	44.49
New working banks[c]	56.99	56.67
Total New Sample	49.78	45.09
Total RDD	62.48	55.76
Field	73.49	73.39
Total Sample	**62.71**	**56.49**

[a]Combined household-level response rate and FIU-level response rate within responding households.

[b]Working banks in existence at the time the Round Three sample was selected.

[c]Working banks added between the end of Round Three and the beginning of Round Four.

Three noncomplete components—which, as expected, had much lower response rates than the Prior-round completes—were undersampled in Round Four and, therefore, have comparably higher sampling weights.

Household-level response rates were higher than FIU-level response rates because some households included multiple FIUs and some of these FIUs did not complete interviews. Although both unweighted and weighted household and FIU response rates are shown, we generally limit our discussion to weighted FIU response rates, since weighted data will be used for most analyses and the FIU was the primary interviewing unit for the Household Survey. In addition, patterns in response rates by sample type and geographic units were the same for households and FIUs.

Weighted response rates varied by type of sample. The Round Four weighted RDD FIU response rate for the overlap sample (all telephone numbers sampled from Round Three) was 60.4 percent, compared to 45.1 percent for new sample (old and new working banks combined). The higher response rate for the overlap sample was due to the high level of cooperation among households whose telephone numbers were selected from Round Three completed interviews (75.7 percent). The interval between rounds was only two and a half years, so most of the families and people interviewed for Round Three were at the same telephone number for Round Four. Because Round Three families had received monetary incentives of $25,[3] most also remembered the interview and knew they would be compensated for participation, a factor that may have contributed to the high response rate.

[3]Nearly all FIUs participating in Round Three received $25 for completing that survey.

Not surprisingly, the weighted FIU response rate was poor for Round Three refusals and other nonresponses (21.0 percent).[4] These households had been contacted many times in both rounds and most had refused, many several times. The FIU response rate for Round Three nonhouseholds (48.9 percent) was slightly higher than the rate for new sample cited above (45.1 percent). This result is not surprising, as the telephone numbers linked to these households were nonresidential at the time of the Round Three survey and therefore were contacted for the first time in Round Four. The low weighted FIU response rate for Round Three telephone numbers that had final dispositions of no answer or mechanical answering device (27.6 percent) was due to the very large fraction of telephone numbers in these subsamples with undetermined residency in both rounds, which resulted in a large fraction having residency imputed.

The patterns for Round Four response rates by sample type were similar to those reported for Round Three (see Technical Publication 46, Tables IV.5 and IV.6, available on the HSC website at www.hschange.com).

b. Patterns in Response Rates

Tables IV.7 and IV.8 show site-level unweighted and weighted response rates by round, respectively. RDD response rates continued to decline in nearly all sites. Across the four rounds, the weighted RDD FIU response rate for site and supplemental samples declined from 64.4 percent in Round One (1996–1997), to 62.3 percent in Round Two (1998–1999), to 57.4 percent in Round Three (2000–2001), to 55.8 percent in Round Four (2003). Individual site response rates for the field sample vary considerably by round due to small sample sizes. However, the overall weighted field FIU response rate remained stable in Round Two (73.3

[4]Other nonresponses include refusals before screening, disability and language barriers, and cases closed at the end of data collection (effort ended).

TABLE IV.7

CTS SITE LEVEL UNWEIGHTED RESPONSE RATES BY ROUND
(Percents)

		Unweighted							
		Round One		Round Two		Round Three		Round Four	
		Household	FIU	Household	FIU	Household	FIU	Household	FIU
	RDD								
0	Supplemental Sample	66.46	64.26	67.18	64.66	68.04	64.22	0	0
1	Boston, MA Portion	59.94	56.72	61.51	57.47	57.93	53.89	58.94	53.74
2	Cleveland-Lorain-Elyria, OH PMSA	63.52	61.47	64.12	62.10	61.80	58.07	68.86	65.40
3	Greenville-Spartanburg-Anderson, SC MSA	70.77	68.96	69.39	67.19	64.01	60.95	65.06	61.95
4	Indianapolis, IN MSA	71.25	70.22	70.22	67.58	63.05	60.69	69.99	67.84
5	Lansing-East Lansing, MI MSA	71.97	70.12	70.64	68.34	67.37	64.54	66.97	63.61
6	Little Rock-North Little Rock, AR MSA	74.29	72.91	72.18	69.64	71.29	68.17	68.78	66.33
7	Miami, FL PMSA	53.21	49.89	54.94	50.58	52.15	46.66	57.83	52.74
8	Newark, NJ PMSA	59.36	56.32	56.76	53.03	58.72	53.77	58.28	53.01
9	Orange County, CA PMSA	55.83	52.35	55.37	50.26	54.95	50.21	55.83	49.76
10	Phoenix-Mesa, AZ MSA	68.54	66.88	65.29	62.06	66.69	62.61	66.74	62.43
11	Seattle-Bellevue-Everett, WA PMSA	65.90	62.89	62.38	59.23	60.07	56.02	62.91	59.63
12	Syracuse, NY MSA	69.00	67.12	71.98	70.46	64.46	61.47	70.49	67.81
13	Atlanta, GA MSA	65.44	62.68	71.19	67.86	62.38	59.77	61.86	59.22
14	Augusta-Aiken, GA-SC MSA	66.06	64.08	69.03	66.93	67.92	63.98	68.09	63.43
15	Baltimore, MD PMSA	65.03	63.47	67.07	64.86	65.26	60.52	65.27	60.74
16	Bridgeport-Danbury-Stamford, CT Portion	54.65	52.44	58.54	53.82	63.08	59.27	62.33	59.03
17	Chicago-Kenosha-Kankakee, IL-WI PMSA	60.99	57.83	57.40	53.48	61.18	58.88	62.46	58.53
18	Columbus, OH MSA	69.67	65.88	68.49	66.31	69.89	66.06	72.44	69.96
19	Denver-Boulder-Greeley, CO PMSA	66.08	64.10	65.89	61.42	61.79	59.23	66.44	63.45
20	Detroit, MI PMSA	66.44	62.78	60.83	59.76	60.19	56.18	64.63	60.90
21	Greensboro-Winston Salem-High Point, NC MSA	68.33	66.60	70.93	68.74	66.81	63.89	68.71	66.24
22	Houston-Galveston-Brazoria, TX PMSA	64.14	60.47	59.83	57.18	57.66	54.63	62.57	57.60
23	Huntington-Ashland, WV-KY-OH MSA	75.13	73.45	74.45	71.96	71.44	69.16	71.51	69.77
24	Killeen-Temple, TX MSA	73.17	70.80	73.34	71.64	67.82	65.47	70.26	67.67
25	Knoxville, TN MSA	72.06	70.48	68.74	67.37	66.84	65.21	76.61	73.50
26	Las Vegas, NV-AZ MSA	58.52	54.44	61.63	58.58	63.95	59.17	64.74	61.63
27	Los Angeles-Long Beach, CA PMSA	53.99	51.25	56.16	52.31	56.92	52.73	57.37	51.63
28	Middlesex-Trenton, NJ PMSA	66.07	63.82	65.44	62.83	63.85	60.72	62.82	57.04
29	Milwaukee-Racine, WI PMSA	68.77	67.68	70.95	68.43	72.79	71.17	76.95	74.79
30	Minneapolis-St Paul, MN-WI MSA	76.74	73.87	76.03	73.89	81.87	79.41	72.63	68.37
31	Modesto, CA MSA	64.76	63.11	66.97	62.90	66.29	62.56	69.33	65.83
32	Nassau-Suffolk, NY PMSA	59.63	56.95	61.15	55.27	57.48	53.79	64.42	59.08
33	New York City, NY PMSA	46.27	42.76	57.06	50.52	50.57	45.76	56.76	51.12
34	Philadelphia, PA-NJ PMSA	64.80	62.38	59.52	56.80	57.11	51.85	64.58	60.28
35	Pittsburgh, PA MSA	64.99	62.88	67.83	66.03	66.67	61.96	73.44	69.28

TABLE IV.7 (*Continued*)

		Unweighted							
		Round One		Round Two		Round Three		Round Four	
		Household	FIU	Household	FIU	Household	FIU	Household	FIU
36	Portland-Salem, OR-WA PMSA	68.46	64.87	72.14	69.11	71.57	68.31	70.94	67.41
37	Riverside-San Bernardino, CA PMSA	65.57	63.48	64.83	61.59	63.60	59.89	59.38	56.09
38	Rochester, NY MSA	70.47	68.54	70.77	68.28	69.82	66.19	79.97	76.99
39	San Antonio, TX MSA	63.45	61.39	67.27	63.22	66.91	63.12	71.90	67.18
40	San Francisco, CA PMSA	51.24	47.52	54.78	50.44	55.98	48.89	51.43	46.31
41	Santa Rosa, CA PMSA	60.15	55.84	62.21	59.38	60.65	58.42	63.00	56.89
42	Shreveport-Bossier City, LA MSA	71.65	68.22	71.25	68.48	68.50	65.11	67.84	64.63
43	St. Louis, MO-IL MSA	72.71	69.23	74.68	72.96	70.73	68.81	75.70	71.66
44	Tampa-St Petersburg-Clearwater, FL MSA	60.32	57.74	57.98	54.94	60.30	57.76	63.26	60.43
45	Tulsa, OK MSA	63.80	62.10	70.12	65.78	67.00	63.93	69.67	66.71
46	Washington-Hagerstown, DC-MD-VA-WV PMSA	65.59	63.94	68.23	65.05	63.82	59.25	62.77	59.12
47	West Palm Beach-Boca Raton, FL MSA	55.42	50.98	53.93	49.99	47.03	44.78	56.15	52.76
48	Worcester-Fitchburg, MA Portion	63.91	62.11	66.13	62.38	63.31	60.12	64.77	60.76
49	Dothan, AL MSA	69.81	68.45	72.75	71.67	67.48	64.59	73.00	69.93
50	Terre Haute, IN MSA	74.38	72.17	67.64	64.98	67.00	65.62	68.99	67.61
51	Wilmington, NC MSA	76.18	73.28	71.96	69.22	66.56	63.97	70.62	66.12
52	West-Central Alabama	71.54	69.43	70.48	68.62	71.90	67.29	74.50	70.94
53	Central Arkansas	75.94	75.34	74.61	73.45	76.88	75.23	78.89	77.54
54	Northern Georgia	72.87	69.81	70.48	67.88	64.18	60.42	66.94	63.44
55	Northeast Illinois	67.77	67.32	71.32	68.93	70.75	69.15	73.88	72.57
56	Northeast Indiana	72.74	70.76	71.05	69.52	68.89	67.72	74.13	72.30
57	Eastern Maine	80.32	79.08	81.82	81.57	78.87	76.98	77.49	75.68
58	Eastern North Carolina	77.24	75.26	75.04	72.08	72.10	69.42	73.55	71.38
59	Northern Utah	78.79	76.76	83.19	82.19	80.40	78.22	81.39	79.26
60	Northwest Washington	70.43	68.97	70.90	67.37	70.76	68.43	70.75	68.34
	All high-intensity sites	65.07	62.69	64.16	60.97	61.57	57.70	63.94	59.94
	All low-intensity sites	66.59	64.13	67.38	64.45	65.67	62.44	67.98	64.44
	Total RDD site sample	65.84	63.42	65.77	62.71	63.64	60.09	66.22	62.48
	Total RDD (supplemental + site)	65.90	63.50	65.92	62.91	64.05	60.47	66.22	62.48
	Field								
1	Boston, MA Portion	75.42	75.42	74.07	74.07	58.74	57.16	87.44	87.44
2	Cleveland-Lorain-Elyria, OH PMSA	73.25	73.25	84.71	84.71	86.16	86.16	88.24	83.15
3	Greenville-Spartanburg-Anderson, SC MSA	83.73	83.73	83.41	83.41	89.97	89.03	80.50	74.93
4	Indianapolis, IN MSA	89.10	89.10	82.99	82.99	69.20	66.54	82.88	77.98
5	Lansing-East Lansing, MI MSA	72.38	72.38	70.42	70.42	67.55	67.55	75.33	73.24
6	Little Rock-North Little Rock, AR MSA	90.43	90.43	80.97	80.97	86.72	84.80	82.01	76.15
7	Miami, FL PMSA	95.40	95.40	71.00	71.00	90.34	90.34	90.31	88.11
8	Newark, NJ PMSA	69.68	69.68	56.26	56.26	62.61	61.10	69.58	66.07
9	Orange County, CA PMSA	53.04	53.04	61.52	61.52	79.15	79.15	62.35	45.72
10	Phoenix-Mesa, AZ MSA	93.14	93.14	96.28	96.28	99.29	98.57	98.52	93.72

TABLE IV.7 (*Continued*)

		Unweighted							
		Round One		Round Two		Round Three		Round Four	
		Household	FIU	Household	FIU	Household	FIU	Household	FIU
11	Seattle-Bellevue-Everett, WA PMSA	69.44	69.44	26.53	26.53	35.34	35.34	24.67	22.91
12	Syracuse, NY MSA	93.22	93.22	67.38	67.38	86.27	82.89	76.87	76.87
	Total field sample	84.60	84.60	79.17	79.17	71.44	70.15	77.86	73.49
	RDD Site Sample + Field								
1	Boston, MA Portion	60.05	56.87	61.56	57.55	57.94	53.97	59.17	54.04
2	Cleveland-Lorain-Elyria, OH PMSA	63.80	61.81	65.02	63.07	62.62	59.02	69.71	66.17
3	Greenville-Spartanburg-Anderson, SC MSA	71.31	69.57	70.40	68.37	65.26	62.33	66.49	63.14
4	Indianapolis, IN MSA	72.18	71.21	71.03	68.59	63.59	61.20	71.22	68.71
5	Lansing-East Lansing, MI MSA	71.98	70.16	70.64	68.40	67.38	64.60	67.19	63.88
6	Little Rock-North Little Rock, AR MSA	75.00	73.70	72.67	70.30	71.97	68.91	69.71	66.99
7	Miami, FL PMSA	53.99	50.74	55.19	50.90	53.00	47.71	58.49	53.50
8	Newark, NJ PMSA	59.80	56.87	56.74	53.17	59.01	54.36	59.18	54.09
9	Orange County, CA PMSA	55.81	52.37	55.41	50.34	55.14	50.45	55.89	49.68
10	Phoenix-Mesa, AZ MSA	69.53	67.95	67.61	64.69	68.55	64.76	68.91	64.61
11	Seattle-Bellevue-Everett, WA PMSA	66.07	63.18	60.94	57.91	58.05	54.30	61.38	58.16
12	Syracuse, NY MSA	69.72	67.89	71.81	70.36	64.93	61.94	70.62	68.03
	High-intensity sites (with field)	65.61	63.30	64.59	61.54	62.00	58.26	64.59	60.59
	Sites Grouped by Population Size (RDD Site Sample)								
	3 million+	60.32	57.26	61.04	57.34	58.13	54.13	60.86	56.24
	2-3 million	62.55	59.87	61.98	58.43	60.59	56.42	63.87	59.51
	1-2 million	65.26	62.90	65.04	61.90	64.13	60.38	66.72	62.89
	<1 million large MSA	68.56	66.43	68.91	66.30	65.54	62.52	67.36	64.14
	Small MSA (<200,000)	73.41	71.27	70.88	68.77	67.05	64.73	70.84	67.90
	Non-MSA	74.19	72.56	74.42	72.51	73.07	70.61	74.61	72.34
	Total (RDD site + supplemental + field)	**66.16**	**63.80**	**66.15**	**63.21**	**64.19**	**60.67**	**66.47**	**62.71**

TABLE IV.8

CTS SITE LEVEL WEIGHTED RESPONSE RATES BY ROUND
(Percentages)

		Weighted							
		Round One		Round Two		Round Three		Round Four	
		Household	FIU	Household	FIU	Household	FIU	Household	FIU
	RDD								
0	Supplemental Sample	66.89	64.73	65.61	63.06	61.85	58.27	0	0
1	Boston, MA Portion	59.94	56.72	59.88	55.97	52.85	49.04	50.56	45.84
2	Cleveland-Lorain-Elyria, OH PMSA	63.53	61.47	61.89	59.87	56.16	52.78	58.39	55.07
3	Greenville-Spartanburg-Anderson, SC MSA	70.77	68.96	67.60	65.33	59.37	56.23	57.47	54.17
4	Indianapolis, IN MSA	71.25	70.22	68.50	65.96	58.62	56.31	62.25	60.46
5	Lansing-East Lansing, MI MSA	71.97	70.11	68.32	66.10	61.99	59.24	59.41	56.64
6	Little Rock-North Little Rock, AR MSA	74.29	72.91	70.57	68.09	65.93	62.72	62.71	60.34
7	Miami, FL PMSA	53.22	49.90	54.04	49.74	47.83	42.78	49.91	45.25
8	Newark, NJ PMSA	59.36	56.32	55.48	51.75	52.77	48.32	48.97	44.18
9	Orange County, CA PMSA	55.83	52.35	53.90	48.66	48.93	44.79	45.24	40.13
10	Phoenix-Mesa, AZ MSA	68.53	66.87	62.98	59.80	61.46	57.75	58.31	53.75
11	Seattle-Bellevue-Everett, WA PMSA	65.90	62.88	60.53	57.52	55.10	51.39	54.80	51.97
12	Syracuse, NY MSA	69.00	67.12	69.78	68.35	59.56	56.89	62.46	59.78
13	Atlanta, GA MSA	65.44	62.68	69.08	65.81	60.22	57.55	56.75	54.30
14	Augusta-Aiken, GA-SC MSA	66.06	64.08	67.22	65.10	62.86	59.53	63.16	59.04
15	Baltimore, MD PMSA	65.03	63.47	66.06	63.83	60.27	55.74	57.92	53.77
16	Bridgeport-Danbury-Stamford, CT Portion	54.65	52.44	57.01	52.48	57.79	54.16	53.17	50.01
17	Chicago-Kenosha-Kankakee, IL-WI PMSA	60.99	57.83	55.78	51.87	55.69	53.63	55.86	52.45
18	Columbus, OH MSA	69.67	65.88	67.36	65.24	66.81	62.97	63.00	61.03
19	Denver-Boulder-Greeley, CO PMSA	66.08	64.10	64.11	59.28	58.18	55.54	59.66	56.99
20	Detroit, MI PMSA	66.44	62.78	59.30	58.27	56.91	53.15	58.04	54.85
21	Greensboro-Winston Salem-High Point, NC MSA	68.33	66.60	68.64	66.56	61.77	59.12	61.89	59.23
22	Houston-Galveston-Brazoria, TX PMSA	64.14	60.47	58.79	56.23	55.54	52.45	57.98	52.94
23	Huntington-Ashland, WV-KY-OH MSA	75.13	73.45	72.70	70.26	66.48	64.49	66.91	64.68
24	Killeen-Temple, TX MSA	73.17	70.80	72.08	70.29	64.48	62.20	62.40	60.30
25	Knoxville, TN MSA	72.06	70.48	66.91	65.60	62.41	60.99	69.07	65.74
26	Las Vegas, NV-AZ MSA	58.52	54.44	60.22	57.26	58.96	54.46	56.46	52.35
27	Los Angeles-Long Beach, CA PMSA	53.99	51.25	55.22	51.39	53.31	49.37	50.41	45.24
28	Middlesex-Trenton, NJ PMSA	66.07	63.82	64.05	61.48	59.01	56.11	54.46	49.55
29	Milwaukee-Racine, WI PMSA	68.77	67.68	67.83	65.42	69.54	67.67	72.89	69.86
30	Minneapolis-St Paul, MN-WI MSA	76.74	73.87	74.36	72.32	79.06	76.77	67.59	63.16

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TABLE IV.8 (*Continued*)

		Weighted							
		Round One		Round Two		Round Three		Round Four	
		Household	FIU	Household	FIU	Household	FIU	Household	FIU
31	Modesto, CA MSA	64.76	63.11	65.09	60.77	60.62	56.98	60.52	57.38
32	Nassau-Suffolk, NY PMSA	59.63	56.95	59.14	53.33	52.35	49.10	54.76	49.62
33	New York City, NY PMSA	46.27	42.76	55.17	48.58	48.22	43.60	48.95	43.87
34	Philadelphia, PA-NJ PMSA	64.80	62.38	58.38	55.61	55.34	50.16	55.91	51.95
35	Pittsburgh, PA MSA	64.99	62.88	65.61	63.91	62.65	58.24	63.96	59.97
36	Portland-Salem, OR-WA PMSA	68.46	64.87	70.02	67.03	67.37	64.30	61.86	58.79
37	Riverside-San Bernardino, CA PMSA	65.57	63.48	63.58	60.30	60.70	57.06	54.24	50.91
38	Rochester, NY MSA	70.47	68.54	68.90	66.41	64.99	61.60	70.72	67.73
39	San Antonio, TX MSA	63.45	61.39	65.17	60.95	63.52	60.01	66.18	61.97
40	San Francisco, CA PMSA	51.24	47.52	52.77	48.45	50.19	43.85	45.15	40.68
41	Santa Rosa, CA PMSA	60.15	55.84	60.37	57.62	55.55	53.54	56.66	50.88
42	Shreveport-Bossier City, LA MSA	71.65	68.22	69.98	67.21	63.76	60.55	60.89	57.90
43	St. Louis, MO-IL MSA	72.71	69.23	73.26	71.62	67.29	65.50	67.20	63.82
44	Tampa-St Petersburg-Clearwater, FL MSA	60.32	57.74	54.99	52.20	56.16	53.87	54.68	51.96
45	Tulsa, OK MSA	63.80	62.10	67.87	63.68	63.04	60.24	62.68	59.43
46	Washington-Hagerstown, DC-MD-VA-WV PMSA	65.59	63.94	67.06	64.02	60.61	55.81	55.47	52.25
47	West Palm Beach-Boca Raton, FL MSA	55.42	50.98	51.82	48.05	42.50	40.53	49.23	45.59
48	Worcester-Fitchburg, MA Portion	63.91	62.11	64.88	60.69	58.28	55.33	54.81	50.42
49	Dothan, AL MSA	69.81	68.45	70.88	69.84	63.47	60.84	61.79	59.05
50	Terre Haute, IN MSA	74.38	72.17	66.19	63.60	61.33	60.07	61.29	59.87
51	Wilmington, NC MSA	76.18	73.28	70.57	67.81	60.57	57.91	64.69	60.27
52	West-Central Alabama	71.54	69.43	69.14	67.20	64.84	60.45	65.20	61.42
53	Central Arkansas	75.94	75.34	72.85	71.72	71.35	69.52	68.71	67.10
54	Northern Georgia	72.87	69.81	68.70	66.24	58.26	54.72	61.84	58.78
55	Northeast Illinois	67.77	67.32	68.07	65.80	64.82	63.33	65.18	64.12
56	Northeast Indiana	72.74	70.76	69.02	66.68	62.13	61.05	63.93	62.19
57	Eastern Maine	80.32	79.08	80.30	80.06	74.80	73.04	72.17	70.49
58	Eastern North Carolina	77.24	75.26	73.99	71.08	66.82	64.41	63.62	61.95
59	Northern Utah	78.79	76.76	82.73	81.76	75.33	73.28	71.37	69.73
60	Northwest Washington	70.43	68.97	69.35	65.81	63.75	61.57	61.39	59.22
	All high-intensity sites	64.96	62.54	62.44	59.29	56.30	52.72	55.49	51.82
	All low-intensity sites	67.79	65.43	66.75	63.97	61.99	59.11	61.12	57.94
	Total RDD site sample	66.59	64.21	64.95	62.00	59.56	56.37	59.12	55.76
	Total RDD (supplemental + site)	66.64	64.37	65.04	62.30	60.74	57.35	59.12	55.76
	Field								
1	Boston, MA Portion	90.39	90.39	63.96	63.96	41.20	40.18	93.14	93.14
2	Cleveland-Lorain-Elyria, OH PMSA	72.15	72.15	78.68	78.68	76.74	76.74	87.71	76.54
3	Greenville-Spartanburg-Anderson, SC MSA	82.65	82.65	83.82	83.82	91.07	90.47	78.34	73.32

TABLE IV.8 (*Continued*)

		Weighted							
		Round One		Round Two		Round Three		Round Four	
		Household	FIU	Household	FIU	Household	FIU	Household	FIU
4	Indianapolis, IN MSA	89.74	89.74	83.12	83.12	74.56	72.58	82.69	77.10
5	Lansing-East Lansing, MI MSA	68.96	68.96	67.01	67.01	65.83	65.83	72.66	71.42
6	Little Rock-North Little Rock, AR MSA	91.04	91.04	83.44	83.44	87.68	86.63	82.84	78.33
7	Miami, FL PMSA	94.01	94.01	72.44	72.44	88.45	88.45	91.10	90.18
8	Newark, NJ PMSA	68.93	68.93	46.86	46.86	63.10	61.73	66.63	63.47
9	Orange County, CA PMSA	56.61	56.61	66.75	66.75	80.63	80.63	61.68	47.03
10	Phoenix-Mesa, AZ MSA	89.26	89.26	97.24	97.24	98.95	98.59	97.87	93.77
11	Seattle-Bellevue-Everett, WA PMSA	72.28	72.28	31.33	31.33	41.58	41.58	46.03	43.64
12	Syracuse, NY MSA	92.53	92.53	78.28	78.28	88.43	83.49	75.99	75.99
	Total field sample	83.20	83.20	73.30	73.30	73.50	72.60	77.45	73.39
	RDD Site Sample + Field								
1	Boston, MA Portion	60.46	57.36	59.90	56.04	53.55	49.73	50.99	46.32
2	Cleveland-Lorain-Elyria, OH PMSA	63.97	62.09	63.06	61.22	58.80	55.43	59.65	56.00
3	Greenville-Spartanburg-Anderson, SC MSA	71.34	69.66	68.90	66.88	68.62	65.44	62.51	58.78
4	Indianapolis, IN MSA	73.47	72.61	69.70	67.52	68.01	65.50	65.56	62.97
5	Lansing-East Lansing, MI MSA	71.78	70.13	68.23	66.29	68.60	65.85	60.97	58.43
6	Little Rock-North Little Rock, AR MSA	76.06	74.89	72.32	70.36	72.23	69.00	65.42	62.73
7	Miami, FL PMSA	55.42	52.33	54.42	50.27	58.23	53.41	53.62	49.45
8	Newark, NJ PMSA	60.92	58.57	53.54	51.09	62.61	58.04	52.22	47.83
9	Orange County, CA PMSA	55.84	52.46	54.02	48.85	50.22	46.11	45.54	40.19
10	Phoenix-Mesa, AZ MSA	70.04	68.56	67.45	64.85	70.43	66.84	64.49	60.15
11	Seattle-Bellevue-Everett, WA PMSA	66.71	64.24	57.18	54.89	60.13	56.38	53.98	51.02
12	Syracuse, NY MSA	71.39	69.74	70.20	68.89	62.60	59.75	63.03	60.57
	High-intensity sites (with field)	66.21	64.07	62.85	60.13	62.14	58.54	57.87	54.18
	Sites Grouped by Population Size (RDD Site Sample)								
	3 million+	59.62	56.59	59.12	55.34	54.32	50.48	53.32	49.05
	2-3 million	62.36	59.66	60.05	56.52	55.54	51.75	55.31	51.32
	1-2 million	65.42	63.07	63.66	60.59	59.18	55.77	59.04	55.65
	<1 million large MSA	68.33	66.15	66.76	64.17	60.38	57.48	59.75	56.55
	Small MSA (<200,000)	73.75	71.50	69.68	67.48	61.66	59.32	62.94	59.79
	Non-MSA	74.28	72.64	73.01	71.03	67.25	64.93	66.03	63.97
	Total (RDD site + supplemental + field)	**67.04**	**64.82**	**65.10**	**62.46**	**61.95**	**58.56**	**59.88**	**56.49**

percent), Round Three (72.6 percent), and Round Four (73.4), after declining somewhat from Round One (83.2 percent).

For all four rounds, RDD response rates varied inversely with the size of the site population. (Field response rates were computed for individual high-intensity sites and overall, but they could not be computed for groups of sites.) For Round One, the weighted FIU RDD response rate ranged from a low of 56.6 percent in MSAs of 3 million or more people to a high of 72.6 percent in nonmetropolitan areas. Although response rates declined in nearly all areas, the trend by site population was similar for other rounds, varying from 55.3 to 71.0 percent in Round Two, from 50.5 to 64.9 percent in Round Three, and from 49.0 to 64.0 percent in Round Four. Response rates for MSAs of 3 million or more (49.0 percent) and 2 to 3 million (51.3 percent) were particularly low. The larger MSAs may have lower response rates because they correspond to the largest media markets, whose residents are subject to greater telemarketing and market research penetration. However, respondent resistance to survey participation increased in all areas of the country.

c. Comparison of Rounds Two, Three, and Four Response Rates, by Sample Group

Unlike Round One, which did not have an overlap sample, the second, third, and fourth rounds of the CTS had similar sample designs. A comparison of response rates by sample group shows a decline in the RDD weighted overlap sample response rate from Round Two (65.5 percent) to Round Three (60.8 percent), but almost no change between Round Three and Round Four (60.4 percent) (Table IV.9). On the other hand, the RDD response rate for new sample (old and new banks combined) declined monotonically from Round Two (59.1 percent), to Round Three (49.8 percent), to Round Four (45.1 percent).

The stability in the overlap sample response rate was due to the impact of completed prior-round interviews, a group whose response rate decreased relatively little over time. As noted

TABLE IV.9

COMPARISON OF FIU RESPONSE RATES
BY SAMPLE GROUP FOR ROUNDS TWO, THREE, AND FOUR

	Unweighted			Weighted		
	Round Two	Round Three	Round Four	Round Two	Round Three	Round Four
RDD						
Overlap Sample						
Complete	80.5	73.6	74.9	81.6	75.5	75.7
Noncomplete	40.1	38.9	32.2	39.6	32.3	29.7
Total Overlap	66.7	65.7	68.6	65.5	60.8	60.4
New Sample						
Old Working Banks	56.9	51.2	49.6	58.3	49.8	44.5
New Working Banks	61.4	55.8	57.0	62.4	50.0	56.7
Total New Sample	58.0	51.4	49.8	59.1	49.8	45.1
Total RDD	62.9	60.5	62.5	62.3	57.4	55.8
Field	79.2	70.2	73.5	73.3	72.6	73.4
Total RDD and Field	63.2	60.7	62.7	62.5	58.6	56.5

earlier, prior survey participation and receipt of a monetary incentive also may have increased the likelihood of their participation in Round Four. Among telephone numbers sampled for the first time, response rates for numbers selected from new working banks have consistently been higher than those selected from working banks that existed when the previous survey was conducted. We do not have a strong hypothesis for why this pattern occurred, although households assigned new telephone numbers may be more receptive to telephone calls, perhaps because they are not yet receiving as many telemarketing and market research calls.

The weighted field response rate changed little across rounds (73.3, 72.6, and 73.4 percent, respectively), indicating that the people in low-income areas are still very responsive to personal visits.

3. Response Rates for the Adult Self-Response Modules and Child's Physician Visit

The initial FIU interview was conducted with an informant who answered for all sampled FIU members. However, each adult in the FIU was asked to self-respond to a subset of subjective questions (the self-response module). Although the length of the self-response module has increased with each round, we have been able to sustain completion rates of 93 to 94 percent across the three rounds (Table IV.10). In certain circumstances, such as when an adult FIU member was too ill to respond, temporarily unavailable, or unwilling to respond after several interviewing efforts had been made, the family informant was allowed to complete the self-response module for that FIU member. The use of proxies declined over the first three rounds, from 2.3 percent of the self-response modules in Round One, to 1.6 percent in Round Two, to 0.9 percent in Round Three; it then increased slightly to 1.7 percent in Round Four.

TABLE IV.10

RESPONSE RATES FOR THE CTS ADULT SELF-RESPONSE MODULE, BY ROUND
(Percents)

	Round One	Round Two	Round Three	Round Four
Completed Module	94.5	94.0	94.3	92.8
Proxy Accepted				
Illness	0.5	0.5	0.6	0.6
Away and unavailable	0.6	0.7	0.1	0.1
Language barrier	0.1	0.1	0.0	0.0
Other or unspecified reason	1.1	0.3	0.2	1.0
Refused or Unable to Complete for Other Reasons	3.2	4.4	4.8	5.5
Total	100.0	100.0	100.0	100.0
Number of Adults	**49,807**	**48,724**	**49,603**	**39,260**

D. EFFORTS TO INCREASE RESPONSE TO THE SURVEY

During data collection, we used several methods to increase response, including:

- Making at least 30 calls to determine residency and 50 or more calls to complete interviews with residential households (the average number of calls to a telephone number with undetermined residency was 24, and it was 7 for cases ultimately coded as nonresidences).
- Offering Spanish-speaking interviewers to respondents who preferred to conduct the interview in that language.
- Making multiple rounds of refusal conversion calls (using more experienced interviewers); the number of rounds would vary by case, depending on the firmness of the refusal.
- Offering monetary incentives.
- Leaving messages on mechanical answering devices.

There were seven respondent time slots defined over the interviewing week:

- Weekdays 9 A.M. to 6 P.M.
- Weekdays 6 P.M. to 8 P.M.
- Weekdays 8 P.M. to 9 P.M.
- Saturday 9 A.M. to 12 P.M.
- Saturday 12 P.M. to 9 P.M.
- Sunday 9 A.M. to 5 P.M.
- Sunday 5 P.M. to 9 P.M.

At the beginning of each time slot, an algorithm was used to calculate a priority for each non-appointment case based on the number of days since the case was last attempted, the number of attempts in the current time slot, and the number of attempts in all the other time slots. This algorithm was constructed so that, initially, a case would be called in each time slot, one call per day. Then it would be called in each time slot, one call every other day, then every third day, and so on (assuming adequate available sample and staffing).

1. Follow-Up Calls for the RDD Sample

Telephone numbers in the RDD sample were controlled by the CATI scheduler, which randomly assigned sampled telephone numbers to interviewers. Nonscheduled calls were based on optimal calling patterns (according to the algorithm described above), dispersed over different times of the day and different days of the week. (As described in Chapter III, the survey introduction for the initial call varied according to whether the telephone number was linked to a household that had been interviewed in Round Three and whether a letter had been mailed before the call.) Firm appointments were scheduled within a 20-minute window; other appointments were scheduled within a 60-minute time period, based on information the interviewer provided. Separate queues were set up for Spanish-speaking interviews and for refusal conversions (discussed below).

2. Follow-Up Calls for the Field Sample

Interviewers screened dwelling units selected for the field sample to identify households that had not had landline telephone service for two weeks or more in the past 12 months. Field interviewers made up to six visits to complete the household interview. Refusal rates were low, and we did not make refusal conversion calls for the field sample. However, considerable effort was made to obtain access to locked apartment buildings, which made up a significant portion of sampled dwellings in some interviewing areas. This included letters and calls by the field survey director to supplement efforts by field interviewers and the field supervisor.

3. Interviews Conducted in Spanish

We prepared a Spanish version of the CATI instrument and trained bilingual telephone interviewers to conduct interviews with family informants or adults for whom self-response modules were required and who preferred to conduct the interview in Spanish. In addition, two

of the field interviewers (one in Miami and one in Orange County) spoke Spanish; in other sites, field interviewers attempted to use family members to translate the screener questions, when necessary. A summary of the percentage of family interviews completed in Spanish by site during the first three rounds of the CTS is included in Table IV.2 of Technical Publication 46 on HSC's website. Because of a computing problem, comparable data for Round Four are unavailable.

4. Refusal Conversions

Based on our experience in prior rounds of the CTS Household Survey, we anticipated a high volume of refusals and trained a pool of our best interviewers to convert refusals. Refusal converters used information about the reason and intensity of the prior refusals in planning their calls. We attempted to convert refusals with interviewing units (households, FIUs, or individuals) that had refused up to three times, with a few contacted more often.[5] To minimize antagonizing respondents, we allowed a minimum of four weeks between refusal conversion attempts.[6] The refusal pool included respondents who hung up the telephone before the interviewer completed the introduction (HUDIs), those who said they preferred not to be interviewed (refusals), those who terminated the call after the screener was completed (breakoffs), and those with electronic privacy managers.[7]

[5]Since refusal conversion rates are performance measures, we report unweighted conversion rates.

[6]Typically, a final status code of refusal would be assigned after two or three refusals; however, a few cases were tried more often if the supervisor felt that the prior refusals might have been miscoded and the respondent was simply busy when the interviewer called.

[7]A privacy manager is a call-screening device that works with Caller ID to intercept and identify incoming calls. The privacy manager requests the caller's name, which appears on the Caller ID box. The recipient can then choose to accept or reject the call, send the call to a mechanical answering device, or send a scripted rejection to solicitors.

Overall, at least one refusal occurred in 16,785 households, or 38.5 percent of the 43,571 households for which residency was determined (see Table IV.11). Refusal conversion efforts were necessary to achieve a high response rate, since at least one FIU interview was completed in 36.1 percent of the households that refused the initial call (Table IV.11). Conversion rates were more successful among Round Three completes in the overlap sample (48.3 percent were converted) than with Round Three non-interviews (15.3 percent) or new and residual sample (31.2 percent). Most of the refusal conversions occurred after one refusal (21.3 percent), with 7.7 percent occurring after two refusals, and 7.2 percent after three or more.

Refusal conversion efforts are designed to reduce nonresponse and the risk of biases from excluding households reluctant to participate in the survey. Table IV.12 shows the impact of refusal conversion efforts on unweighted response rates for Rounds Two, Three, and Four of the RDD sample. We chose unweighted response rates here to demonstrate the effectiveness of an operational procedure before sample weights were applied. Initial household-level response rates before refusal conversions were higher in Round Two (48.3 percent) than in Round Three (43.6 percent) or Round Four (43.3 percent), with the difference between surveys diminishing with conversion efforts. For Round Two, the difference between the initial and final household-level unweighted response rate was 17.6 percentage points, for Round Three it was 20.5 percentage points, and for Round Four it was 23.0 percentage points. This indicates that the impact of refusal conversions increased between rounds.

5. Monetary Incentives

Throughout the four rounds of the CTS, we used large cash incentives. We did this to (1) minimize the impact of nonresponse, particularly among families that participated in prior rounds; (2) maintain incentives comparable to those offered to people selected for other surveys

TABLE IV.11

ROUND FOUR HOUSEHOLD LEVEL UNWEIGHTED REFUSAL CONVERSION RATES, BY SAMPLE TYPE
(Percents)

Refusal Conversion Attempts[a]	Overlap Round Three Completes	Overlap Round Three Noninterviews	New Sample[c]	Total Sample
Converted After One Refusal	31.9	9.6	14.6	21.3
Converted After Two Refusals	9.5	3.3	7.4	7.7
Converted After Three Or More Refusals[b]	7.0	2.4	9.2	7.2
Total Converted	48.3	15.3	31.2	36.1
Non-Converted	51.7	84.7	68.8	63.9
Number of Households with Refusals	**7,226**	**2,542**	**7,017**	**16,785**

[a]Refusals were defined as respondents who actively refused or hung up the telephone during the survey presentation.

[b]Interviewing supervisors could authorize additional efforts to convert households that refused more than twice; however, most refusals were assigned a final disposition after two refusals.

[c]Old and new working banks combined.

TABLE IV.12

ROUND TWO THROUGH FOUR RDD CUMULATIVE HOUSEHOLD-LEVEL RESPONSE RATES (UNWEIGHTED), BY NUMBER OF REFUSAL CONVERSIONS
(Percent)

	Round Two Household Level	Incremental Change	Round Three Household Level	Incremental Change	Round Four Household Level	Incremental Change
Assumes No Refusal Conversion[a]	48.3	—	43.6	—	43.3	—
Assumes One Refusal Conversion[b]	58.5	10.2	56.5	12.9	56.1	12.9
Assumes One or Two Refusal Conversions[c]	63.7	5.2	61.4	4.9	61.2	5.1
Actual Survey Results[d]	65.9	2.2	64.1	2.7	2.7	5.0

[a]Response rate recomputed, assuming that no efforts were made to convert initial refusals.

[b]Response rate recomputed, assuming that efforts were made to convert only first refusals.

[c]Response rate recomputed, assuming that efforts were made to convert first and second refusals.

[d]Actual household-level unweighted response rate for the RDD sample; supervisors could authorize more than two refusal conversions if they believed prior refusals had not been hostile, and that additional efforts might be effective.

using the CTS as a sample frame, and (3) encourage participation in the self-response module by adults other than the family informant. Because data obtained from the self-response module were critical to many analyses, we did not want to risk losing observations as the length of this module increased. The development of the CTS incentive structure is discussed in technical reports for prior rounds (see Technical Publications 15, 34, and 46 on HSC's website at www.hschange.org).

For Round Four, we offered eligible adults $25 to participate in the survey. However, we shifted from offered to prepaid incentives (mailed checks) late in the survey to encourage responses from families that had refused (most had refused more than once) or that were very difficult to contact and for whom we had current names and addresses. We mailed the check to the person identified as the FIU informant. (In the field sample, respondents received $25 in cash upon completing the interview.)

Table IV.13 shows the results of prepayment efforts used for Rounds Two, Three, and Four. Prepayment efforts were more successful with households that had participated in a prior round of CTS and were more effective in Round Two than in Round Three. The results for Round Four fell somewhere between those of the prior rounds. For Round Two, 41.0 percent of households mailed prepaid incentives completed interviews, compared to 20.7 percent in Round Three and 32.6 percent in Round Four. The completion rate was higher in Round Two than in either Rounds Three or Four for completed interviews in the overlap sample. For overlap noncompleted interviews and new sample, however, completion rates were comparable in Rounds Two and Four but considerably lower in Round Three.

Three differences among procedures used in the three rounds could have affected completion rates. First, the Round Two sample members who were offered incentives were limited to refusers, whereas the Rounds Three and Four incentive sample included both

TABLE IV.13

DISPOSITION OF PRIMARY FIUS IN HOUSEHOLDS OFFERED PREPAID INCENTIVES BY ROUND AND SAMPLE TYPE
(Percent)

	Round Two[b]				Round Three[b]			Round Four[b]		
Disposition	Overlap Round One Complete	Overlap Round One Noncomplete	New Sample[c]	Total	Overlap Round Two Complete	New Sample[c]	Total	Overlap Round Three Complete	New Sample[c]	Total
Complete	42.9	27.5	38.5	41.0	28.0	14.2	20.7	27.1	43.9	32.6
Nonresponse	56.3	68.9	60.6	58.0	64.3	81.3	73.3	69.8	53.9	64.5
Ineligible[a]	0.8	3.5	0.9	1.0	7.7	4.5	6.0	3.1	2.2	2.8
Number of FIUs	3,132	287	899	4,318	3,286	3,713	6,999	3,172	1,575	4,747

[a]Nonresidential, nonworking telephone, cellular telephone, noncivilian household.

[b]The Round Two sample was limited to refusals; the Round Three and Four samples included both refusals and other nonrespondents.

[c]Old and new working banks combined.

households that refused and those that were difficult to contact, which also included a larger number of ineligible cases. Second, the Round Two effort included some cases that were offered $50; the completion rate for the larger incentive was 44.0 percent, versus 38.4 percent for the $25 incentive (see Technical Publication 34 on HSC's website at www.hschange.org). Third, less time was allowed to follow up nonrespondents in Round Three (particularly for the new sample) because the survey effort was truncated after September 11, 2001. Because more time was allowed to complete prepaid cases in Round Four, completion rates were closer to Round Two levels.

6. Messages on Mechanical Answering Devices

Some residential households were difficult to contact because they used mechanical answering devices to screen calls. Interviewers left the following message on the devices to counter these chronic no-answers:

- ***Households That Had Never Participated in the CTS:*** I'm calling for the Community Tracking Study, a research project to see how managed care and other health care changes are affecting people. We're not selling anything or asking for money. We would like your household to participate in a brief interview and we will send each adult $25 for helping us. Please call Jackie Licodo at 1-800-298-3383. Thank you!
- ***Re-interviewed Households:*** I'm calling for the Community Tracking Study, the health care study your household participated in last year. We recently mailed you a letter about the study and would very much like to interview your household again. We will send each adult in your household $25 for helping us Please call Jackie Licodo at 1-800-298-3383. Thank you!

The interviewer also was instructed to leave notes in the CATI system indicating that the message had been left on the answering device, and to reference the message when calling back the next time. A second message could be left after a one-week interval; the limit was two messages per month.

E. QUALITY ASSURANCE

1. RDD Sample

Production reports and regular online monitoring were used to evaluate interviewer performance. Daily production reports provided information on several performance indicators, including completed interviews and self-response modules, number of calls made, number of refusals, refusal conversions, time per call, time per interview, and the ratio of completed interviews to time spent charged to interviewing.

Interviewer conduct during interviews was evaluated primarily by having supervisors monitor actual calls, supplemented by review of interviewers' notes maintained in the CATI system. (The CATI system maintains all calls and notes recorded about monitored calls.) Supervisors monitored approximately 10 percent of the RDD interviews, increasing the monitoring level for new interviewers and those experiencing problems. The monitoring system enables supervisors to listen to interviews without either the interviewer's or respondent's' knowledge. It also allows supervisors to view interviewers' screens while an interview is in progress. Interviewers are informed they will be monitored but do not know when observations will take place. Supervisors concentrate on identifying behavioral problems involving inaccurate presentation of information about the study; errors in reading questions; biased probes; inappropriate use of feedback in responding to questions; and any other unacceptable behavior, such as interrupting the respondent or offering a personal opinion about specific questions or about the survey. The supervisor reviews results with the interviewer after the interviewer completes her or his shift.

2. Field Sample

Eligible households for field interviews (interrupted or no telephone service) were interviewed by cellular telephone and were subject to the same monitoring procedures that were

used for the RDD sample, described above. In addition, for all completed interviews, the telephone center interviewer verified eligibility for the field component.

F. DATA EDITING, CODING, AND CLEANING

One of the most important advantages of computer-assisted surveys is that errors can be identified and corrected during the interview by building logic, range, and consistency checks into the program. The CATI program (CASES) also permits interviewers to back up and change answers to previously answered questions without violating instrument logic.

For Round Three, a combined CATI instrument was developed for the RDD and field components of the survey. Separate Spanish versions of these two components were written, but their structures were the same as those of the corresponding English versions. We used this same structure in Round Four. A cleaning program was written that enforced questionnaire logic. An interview could not be certified as clean until all appropriate questions had either been answered or assigned an acceptable nonresponse value and until the data record for each interview was consistent with the instrument program logic.

Survey questions were primarily closed-ended. Questions on industry were open-ended, and text responses were coded to the two-digit (1987) Standard Industrial Classification (SIC) coding structure.[8] A program was written to read text responses and, based on character strings in the text, to assign two-digit codes. Responses without recognizable patterns were manually coded; in addition, a coder reviewed a sample of computer-generated codes.

Other open-ended items included personal contact information, insurance plan names, employer names, and health conditions (those resulting in an emergency room visit, those for

[8]The SIC has been replaced with the North American Industry Classification (NAIC) System. However, to maintain consistency across all four rounds of the survey, we retained the industry categories used in prior rounds.

which there were unmet health care needs, and preexisting conditions not covered by health insurance). The health condition questions were coded using the ICD-9 coding structure.[9] Personal identifying information remained confidential and was maintained in a separate file used only to assign respondent payments and subsequent interviews.

G. REFORMATTING DATA FILES AND FILE DELIVERY

A program was written to reformat the cleaned instrument responses into FIU- and person-level data files. SSS then prepared analysis files in SAS, and additional edits were performed. The additional edits included checks on the number of missing values for FIU- and person-level data, checks on relationship codes, deletion of FIU and person records for which inconsistencies among relationships could not be resolved, assignment of additional nonresponse values, and some constructed variables. Weights were applied to the data files (see Chapter V), and weighted data files were delivered to SSS, which was responsible for building the public use files. MPR maintained instrument cleaning and reformatting programs used in the preparation of these files.

[9]The ICD-9 is used to classify morbidity and mortality information for statistical purposes and for the indexing of hospital records by disease and operations for data storage and retrieval.

V. WEIGHTING AND ESTIMATION

A. OVERVIEW

In this chapter, we discuss weighting and estimation procedures. The CTS Household Survey sample design was complex, using stratification, clustering, and oversampling to produce national- and community-level estimates. Using unweighted data is likely to produce seriously biased estimates because the unweighted samples are distributed differently than the populations they represent. Weights were designed to restore proportionality to the sample and were adjusted to compensate for nonresponse at the household, FIU, and person levels. This difference in proportionality occurred for the following reasons:

- ***Design***. Fixed sample sizes for sites, restricting the high-intensity sites to MSAs with populations of 200,000 or more, and subsampling children and other groups (such as adults selected for the Baker symptom response module) resulted in different sampling rates for population subgroups.
- ***Incomplete Sample Frame Coverage***. The RDD frame excluded telephone banks of 100 numbers containing no published household numbers; the field sample excluded areas with high telephone penetration and was restricted to MSAs with populations of 200,000 or more.
- ***Differing Chances of Selection***. Some households had differing chances of selection because of the number of landline telephones they owned or interruptions in telephone service. Telephone numbers (RDD sample) selected for Round Three were sampled at different rates for Round Four, depending on the final disposition of the case in the prior round.
- ***Nonresponse*.** Survey response rates differed among sites and population subgroups.

Although the correct use of weights in analyzing CTS Household Survey data substantially reduces the bias of estimates resulting from the sample design and survey nonresponse, the weights do not address the potential for bias resulting from item nonresponse or response errors. The procedures used to impute missing data for individual variables will be discussed in the Household Survey Round Four public use file (technical publication, forthcoming). Estimates of

sampling error that do not account for the use of weights and the complex nature of the sample are likely to be severely understated. Specialized software is required to properly estimate standard errors of estimates from this survey; procedures for using different statistical software packages are discussed in "Comparison of Statistical Software Packages for Variance Estimation in the CTS Surveys" (Technical Publication 40 on HSC's website).

1. Weights Provided for Public and Restricted Use Files

Four analysis weights, summarized in Table V.1, are available in both public and restricted use files researchers use when using the Round Four data. Two additional weights are available on the restricted use file for analyses using the Baker symptom response module. Weights were constructed to allow for both site-specific and national estimates for individuals and FIUs.[1] Site-specific estimates are made for an individual site or involve comparisons of sites. In contrast, national estimates involve inferences to a population broader than any one site or group of sampled sites. We use the term *national estimates* to include estimates for subgroups of the national population that are defined by geography or by economic or demographic classifications. The weights are computed using the features of the sampling design; therefore, all weights are design-based.

[1]Throughout this report, "national" refers to the population of the 48 contiguous states and the District of Columbia. It does not include Alaska and Hawaii.

TABLE V.1

NAMES OF ROUND FOUR CTS HOUSEHOLD SURVEY WEIGHTS

	Estimate Type	
Level of Analysis	Site-Specific Estimate	National Estimate
Person	WTPER6	WTPER2
FIU	WTFAM6	WTFAM2
Baker Symptom Response Module[a]	WTSYM6	WTSYM2

[a]Available on the restricted use file only.

For each of these two classes of estimates (national and site-specific), separate weights are provided: for analyzing FIU data and for conducting person-level analyses. A third weight for each class is provided on the restricted use file when analyzing responses to questions from the Baker symptom response module. This series of questions about clinical conditions was added to the CTS household survey instrument in Round Four and is described further in Table III.1. Because certain respondents were randomly selected to be asked this series, we created a separate set of weights to account for this selection.

In many surveys, nonresponse, poststratification, and other adjustments can introduce variation in the sampling weights. In some situations, the combination of these adjustments produces disproportionately large weights. These large weights can decrease the accuracy and precision of point estimates. We reduced the sampling error caused by extremely large weights by trimming them and distributing the excess among other weights. Although the difference between estimates using the trimmed or untrimmed weights is small, the trimmed weights result in better precision, with little or no additional bias.

2. Constructing Weights

Each weight is the product of several factors:

- An initial weight, the inverse of the probability of selection, to correct for differences in probabilities of selection
- Nonresponse adjustment factors, to correct for differential nonresponse at the individual, FIU, and household levels
- Factors to adjust for interruptions in telephone service
- An adjustment factor that allows for the integration of the RDD and field components
- Poststratification adjustments of weighted counts to external estimates of the population

The weighting steps associated with these factors are outlined in more detail, separately for the RDD and field samples, later in this chapter.

3. Sampling Error Estimation

Because sample-based estimates of population characteristics are not based on the full population, some element of uncertainty is always associated with these estimates. This element of uncertainty, known as *sampling error,* is an indicator of the precision of an estimate. Sampling error is generally measured in terms of the standard error or the sampling variance, which is the square of the standard error.[2]

The complexities of the CTS Household Survey design preclude the use of statistical software packages for variance estimation that do not account for such a design in their algorithms. The variance estimates from these statistical packages may severely underestimate the sampling variance in the Household Survey. Therefore, the CTS data require the use of

[2]The sampling variance is a measure of the variation of an estimator attributable to having sampled a portion of the full population of interest, using a specific probability-based sampling design. The classical population variance is a measure of the variation among the members of the population, whereas a sampling variance is a measure of the variation of the *estimate* of a population parameter (for example, a population mean or proportion) over repeated samples. The population variance is different from the sampling variance in the sense that the population variance is a constant, independent of the sample design, whereas the sampling variance decreases as the sample size increases. The sampling variance is zero when the full population is observed, as in a census.

survey data analysis software or specially developed programs designed to accommodate the sample design and the statistic being estimated.

The sampling variance in the Household Survey is a function of the sampling design and the population parameter being estimated and is referred to as a *design-based sampling variance*. The CTS database contains fully adjusted sampling weights for site-specific estimates and national estimates of FIUs and persons, as well as the information on sample design parameters (that is, strata and clusters) necessary to estimate the sampling variance for a statistic.

Most common statistical estimates and analysis tools (such as percentages, percentiles, and linear and logistic regression) can be implemented using Taylor series approximation methods. Survey data software, such as SUDAAN (Shah et al. 1997), uses the Taylor series linearization procedure and can handle the multistage design, joint inclusion probabilities, and variance components in the Household Survey design.

The rest of this chapter discusses weighting procedures and sampling error estimation for the CTS Household Survey in more detail. Sections B and C discuss the weights for the RDD and field samples, respectively. Section D explains the procedure for integrating the RDD and field samples. Section E describes the procedures to identify and trim extremely large sampling weights. Section F discusses the weights for the Baker symptom response module. Finally, Section G covers sampling error and estimation.

B. WEIGHTING THE RDD COMPONENT

We constructed separate weights for the RDD sample component of the site sample. In Section B.1, we present the general approach for constructing RDD weights at the household, FIU, and person levels. For each level, we describe the relevant sampling weights (defined here as the reciprocal of the probability of selection) and the nonresponse and poststratification

adjustments to the weights. In Section B.2, we present issues pertaining to the construction of the RDD sample weights for national and site-specific estimates.

1. General Weighting Approach

As explained in Chapter II, sampling took place in several stages. In the first stage, we selected the 60 sites (with probability proportional to size) and then randomly selected the high-intensity sites from among the 60. For the RDD sample, we selected telephone numbers, identified households, defined FIUs within households, and collected data on FIUs and people in FIUs (all eligible adults age 18 and older and one randomly selected child). Each of these stages was considered in weighting. The steps necessary for calculating FIU- and person-level weights are listed here and described in the sections that follow:

- Calculate probability of selection of telephone numbers
- Adjust for the telephone number resolution rate (determination of whether the telephone number was a working residential number)
- Adjust for the household screener rate (determination of the household's eligibility using household enumeration questions)
- Adjust for household nonresponse among eligible households
- Adjust for multiple telephones and telephone service interruption within a household
- Poststratify household weights to external estimates of telephone and nontelephone households
- Adjust for secondary FIU nonresponse within responding households
- Calculate the probability of selection for the randomly selected child
- Adjust for high person-level item nonresponse within responding FIU
- Apply the site probability of selection and account for the distribution of cases in high- and low-intensity sites (only for weights used to make national estimates)

a. Telephone Number Initial Weight

The telephone number was the second stage of selection for the site sample.[3] The telephone sampling weight accounted for the probability of selection of telephone numbers within each site, stratum, and overlap sampling category.[4] The probability of selection accounts for the fact that most sampled telephone numbers in Round Four could have been selected for the first time in Round Four or been selected for the first time in one of the previous rounds.

In Rounds Two and Three, we calculated probabilities of selection that accounted for the various ways that a telephone number could have been selected into the sample. By Round Three, these cumulative probabilities had become extremely complex to calculate (for details, see "Round Three Methodology Report," Technical Publication No. 46 on HSC's website). To calculate the probability of selection for Round Four, we used a different approach, making use of the assumption that the overlap sample and the residual sample (new telephone number, old working bank) each independently represented the same population of telephone numbers. We independently weighted the three sample components (overlap, residual, and new), then combined them in a way that accounted for the fact that telephone numbers in the overlap sample had a chance of coming into the sample as a residual case, and vice versa. We did this by applying constant factors to the overlap and residual samples after household-level poststratification, so that their weights then summed to the population, rather than to twice the population.

[3]The site was the first stage of selection for the site sample (see Metcalf et al. 1996).

[4]There are four overlap sampling categories: (1) Round Three complete, (2) Round Three refusal or other nonresponse, (3) Round Three nonhousehold, and (4) Round Three no answer or answering device. There are two new telephone number sampling categories: (1) old working banks ("residual"), and (2) new working banks ("new").

We calculated the probability of selection of a Round Four telephone number within stratum and Round Three disposition. Different methods were used depending on whether the telephone number was (1) part of the overlap sample (that is, Round Three sample members subsampled for Round Four); (2) part of the residual sample (sampled for the first time in Round Four, but theoretically could have been selected in Round Three); or (3) part of the new sample (sampled for the first time in Round Four, and had no chance of selection in Round Three). We address each method separately below.

Probability of Selection in Round Four for Overlap Sample. Because these cases were actually selected in Round Three, we had previously calculated the value of the cumulative probability of selection. This probability already incorporated whether the case could have come into the sample for the first time in Round Three or as part of the Round One or Two sample. We then have to calculate the subsampling rate for Round Four. For overlap cases, the Round Three disposition, *d*, has four values (complete; refusal/other nonresponse; nonhousehold; and no answer/answering device). The subsampling rate is calculated within stratum h[5] and Round Three disposition *d* as:

(2) $$P(\text{overlap case subsampled in R4 given R3 status } d, \text{stratum } h) = \frac{n_{hd}}{N_{hd}} \cdot \frac{nrel_{hd}}{n_{hd} - nbad_{hd}},$$

$d = 1,2,3,4$ *(overlap sample)*

where N_{hd} is the number of Round Three sample telephone numbers; n_{hd} is the number of these telephone numbers initially selected in Round Four; $nbad_{hd}$ is the number of these telephone

[5]Throughout this chapter, we use the term *stratum h*. In the low-intensity sites, in which substratification was not used, stratum *h* refers to the entire site. For the high-intensity sites, it refers to the substrata within sites used in selecting the sample. Strata and substrata are defined in Chapter II, Section E.

numbers found to be nonworking or business numbers before being released (using Genesys ID Plus); and $nrel_{hd}$ is the number of these telephone numbers released for interviewing.

Probability of Selection in Round Four for New Sample. A telephone number *bank* is defined as the first 8 digits of a 10-digit telephone number; a bank has 100 possible 10-digit telephone numbers associated with it. If at least 1 of these 100 possible telephone numbers was listed in a telephone directory as a residential number, then the bank was designated as a *working bank*. New sample did not have a chance of selection in Round Three because these telephone numbers were not in a working bank at the time of the prior round. The probability of selection in Round Four is calculated, within stratum *h*, as:

$$(3)\quad P(\text{new case selected in R4 given not in R3, stratum } h) = \frac{n_{h\text{-}new}}{N_{h\text{-}new}} \cdot \frac{nrel_{h\text{-}new}}{n_{h\text{-}new} - nbad_{h\text{-}new}},$$

where $N_{h\text{-}new}$ is the number of new working telephone banks times 100; $n_{h\text{-}new}$ is the number of these telephone numbers initially selected in Round Four; $nbad_{h\text{-}new}$ is the number of these telephone numbers found to be nonworking or business numbers before release (using Genesys ID Plus); and $nrel_{h\text{-}new}$ is the number of these telephone numbers released for interviewing.

Probability of Selection in Round Four for Residual Sample. Residual sample did have a chance of selection in Round Three because these telephone numbers were in a working bank at the time of the prior round. The probability of selection in Round Four is calculated, within stratum *h*, as:

$$(5)\ P(\text{residual case selected in R4 given not in R3, stratum } h) = \frac{n_{h\text{-}residual}}{N_{h\text{-}residual}} \cdot \frac{nrel_{h\text{-}residual}}{n_{h\text{-}residual} - nbad_{h\text{-}residual}},$$

where $N_{h\text{-}residual}$ is the number of working telephone banks (banks not new to Round Four) times 100; $n_{h\text{-}residual}$ is the number of these telephone numbers initially selected in Round Four as part

of the residual sample; $nbad_{h\text{-}residual}$ is the number of these telephone numbers found to be nonworking or business numbers before release (using Genesys ID Plus); and $nrel_{h\text{-}residual}$ is the number of these telephone numbers released for interviewing.

Sampling Weights. Probability formulas differed slightly, depending on the type of estimate (national or site-specific) for which the weight was designed (described in more detail in Chapter V, Section B.2). Once the probability of selection is calculated, the sampling weight is the reciprocal of that probability of selection:

$$(6) \quad SW(phone_{hd}) = \frac{1}{P(case\ selected\ in\ R4, stratum\ h)} \ .$$

At this stage, the sampling weights for the overlap and residual samples sum to two independent estimates of the population of telephone numbers in working banks at the time of Round Three. Later, we show how they are combined to adjust for the dual probabilities of selection into the two samples.

b. Adjustments for Types of Household-Level Nonresponse

We formed weighting cells to adjust for three kinds of household-level nonresponse: (1) inability to determine whether a sampled telephone number was a working residential number (2) nonresponse to survey questions used to determine whether the household was eligible, and (3) nonresponse to the survey by eligible households (residences that contain at least one eligible adult).[6]

[6]A household was eligible for the interview if it contained at least one civilian adult. People who were not on active military duty at the time of the interview were considered to be civilians. To avoid giving unmarried full-time college students multiple chances of selection, they were excluded from sampled dwellings in which their parents did not reside. Unmarried children younger than age 18 with no parent or guardian in the household also were excluded. Adults on active military duty were classified as ineligible; however, they could have been an FIU

We formed primary weighting cells by crossing site, sampling strata, and Round Three disposition. The Round Three disposition categories used to form cells were (1) Round Three complete, (2) Round Three noncomplete (combining all noncomplete sampling categories), and (3) residual and new sample (not sampled in Round Three). Based on generally accepted guidelines, we decided that each cell should contain at least 20 respondents and that the adjustment factor in each cell should be less than 2. Cells that did not meet these criteria were combined with similar cells.

c. Adjustment to Telephone Weight for Resolution of Residency of Telephone Number

For the telephone number weight, we made an adjustment for the inability to determine whether a sampled telephone number was a working residential number. To adjust for the telephone numbers with undetermined residency, we created the following adjustment factor:

$$(7) \quad A'_{nr}(phone_c) = \frac{\sum_{phone \in c} SW(phone_{hd})}{\sum_{det\ phone \in c} SW(phone_{hd})},$$

for telephone numbers in stratum *h* with disposition *d*, which are in cell *c*, where the numerator is summed over all telephone numbers in cell *c*, and the denominator is summed over telephone numbers in cell *c* with a known residency status.

A telephone number weight adjusted for determination of residency resolution was then calculated for these cases:

(continued)
informant if there was at least one civilian adult in the family. FIUs in which all adults were active-duty military personnel, or were otherwise ineligible, were considered ineligible for the survey.

(8) $W1(phone_{hd}) = SW(phone_{hd}) \cdot A'_{nr}(phone_c)$, if eligibility of telephone number determined

$W1(phone_{hd}) = 0$, otherwise.

After this adjustment, telephone numbers with undetermined residency and telephone numbers known to be ineligible (nonresidential or nonworking) were removed from the weighting process.[7]

d. Screener Nonresponse Adjustment to Household Weight

The next adjustments accounted for whether a residential household was eligible for the survey. To adjust for Round Four households with incomplete information on household eligibility, we created the following household eligibility nonresponse adjustment factor:

$$(7) \quad A'_{nr}(hhold_c) = \frac{\sum_{hh \in c} W1(phone_{hd})}{\sum_{det\ hh \in c} W1(phone_{hd})},$$

for households in stratum *h* with disposition *d*, which are in cell *c*, where the numerator is summed over all telephone numbers in cell *c* known to be households, and the denominator is summed over households in cell *c* with a known survey eligibility status.

A telephone number weight adjusted for determination of household eligibility was then calculated for these cases:

[7]After each weighting adjustment involving eligibility determination (at the telephone number and household levels), we removed cases with undetermined eligibility status and cases known to be ineligible. After each adjustment involving nonresponse among known eligibles (at the household, FIU, and individual levels), we removed the nonrespondents from the remaining steps.

(8) $W1(hhold_{hd}) = W1(phone_{hd}) \cdot A'_{nr}(hhold_c)$, if eligibility of household determined
$W1(hhold_{hd}) = 0$, otherwise.

After this adjustment, households with undetermined eligibility status and households known to be ineligible for the survey were removed from the weighting process.[8]

e. Interview Nonresponse Adjustment to Household Weight

We then adjusted these weights for survey nonresponse among eligible households. A responding household was one in which at least one eligible FIU responded to the survey. We performed a weighting class adjustment for households using the same cells as defined for the household eligibility adjustment. We created a household survey nonresponse adjustment factor as follows:

$$(9) \quad A''_{nr}(survey_c) = \frac{\sum_{elig\ hh \in c} W1(hhold_{hd})}{\sum_{resp\ hh \in c} W1(hhold_{hd})},$$

for households in stratum *h* with disposition *d*, which are in cell *c*, where the numerator is summed over all eligible households in cell *c*, and the denominator is summed over responding eligible households in cell *c*. The following household weight adjusted for survey nonresponse was then calculated for these cases:

(10) $W2(hhold_{hd}) = W1(hhold_{hd}) \cdot A''_{nr}(survey_c)$, if household responded
$W2(hhold_{hd}) = 0$, otherwise.

[8]After each weighting adjustment involving eligibility determination (discussed in Sections B.1.c and B.1.d), we removed cases with undetermined eligibility status and cases known to be ineligible. After each adjustment involving nonresponse among known eligibles (discussed in Sections B.1.e, B.1.h, and B.1.j), we removed the nonrespondents from the remaining steps.

f. Poststratification and Other Adjustments to Household Weight

We then adjusted for more than one telephone in the household and for interruptions in telephone service.[9] Because some households have more than one nonbusiness telephone number, a household multiplicity factor was used to adjust for the number of telephone numbers in the household.[10] This factor, which is the inverse of the total number of these telephones in the household, was applied to the nonresponse-adjusted household weight:

(11) $W3(hhold_{hdi}) = W2(hhold_{hd})/(number\ of\ phones\ in\ household\ i)$.

One of the last steps in creating the household-level weight was to poststratify the sum of the weights to external estimates of current population totals. We created two sets of weights for the RDD sample: (1) ones that sum to telephone households, and (2) ones that sum to all households. We used estimates from the March 2003 Supplement to the CPS (U.S. Census Bureau, [http://www.bls.census.gov/cps/cpsmain.htm]) of the proportion of telephone and nontelephone households nationally (by whether or not in an MSA). For proportions of telephone and nontelephone households in each site, we used data from the Census 2000 Long Form (U.S. Bureau of the Census 2002). For estimates of the number of households with telephone exchanges that are in old working banks or new working banks, we used data from our sampling vendor (Marketing Systems Group-Genesys). In Round Four, we estimated the number of telephone and nontelephone households corresponding to the residual (old working banks) and new (new working banks) sample components, and poststratified separately. The

[9]Question h30 in the Household Survey asked one FIU in the household whether the household had any additional telephone numbers and, if so, how many; in the case of one or more numbers, question h31 asked whether the additional number(s) was (were) for home or business use. If h30 = 1, 2, 3, or 4 and h31 = 1 or 2 (home use or both), we then set the number of telephones equal to h30 plus 1. For all other cases, we set the number equal to 1.

[10]By "nonbusiness telephone number," we mean a telephone number from which the household received nonbusiness calls. Dual-use numbers would fall into this category.

overlap sample weights were poststratified to our best estimates of the number of telephone households with exchanges in working banks in Round Three. We poststratified the weights for the residual sample to the same estimates. The weights for the new working bank sample were poststratified to our best estimates of the number of telephone households with exchanges in new working banks; that is, those that become active after Round Three but before the Round Four sample was selected..

The poststratification adjustment factor for telephone households is:

(12) $$A_{ps\text{-}tel}(\text{metro status, sample}) = \frac{TELHH_{(non)metro,sample}}{\sum_{resp\ hh_i \in (non)metro,sample} W3(hhold_{hdi})}$$ for the national weights,

and

(13) $$A_{ps\text{-}tel}(\text{site, sample}) = \frac{TELHH_{site,sample}}{\sum_{resp\ hh_i \in site,sample} W3(hhold_{hdi})}$$ for the site-specific weights,

where *TELHH* is the estimated number of telephone households in 2003 (for metro United States, nonmetro United States, or by site—for residual or new sample), and the denominator is the sum of the nonresponse-adjusted weights for all responding households in the corresponding category (metro or nonmetro for national weights, site for site-specific weights—for residual or new sample). The household-level weight poststratified to telephone households is:

(14) $$WT_{tel}(hhold_{hdi}) = W3(hhold_{hdi}) \cdot A_{ps\text{-}tel} .$$

To create the weights summing to all households, we used information on telephone service interruption to inflate the RDD sample weights for telephone households to account for

nontelephone households.[11] Even though all cases in the RDD telephone sample had working telephones when interviewed, they were asked whether they had had any interruption in telephone service during the year preceding the interview.[12] We used cases with interruptions in telephone service to represent nontelephone households and those with no reported interruptions to represent telephone households. Then, we adjusted weights to the number of months of interrupted service. The interruption-adjusted weight is:

$$(15) \quad WT_{interruption}(hhold_{hdi}) = \frac{W3(hhold_{hdi})}{proportion\ \ of\ \ \ year\ \ household\ i\ with\ \ \ phone}.$$

The poststratification adjustment factor for total households is:

$$(16) \quad A_{ps\text{-}all}(phone\ status\ g, metro\ status, sample) = \frac{TOTHH_{\,g\text{-}metro\ status, sample}}{\sum_{resp\ \ hhold_i\ \ with\ phone\ status\ g \in metro\ status, sample} WT_{interruption}(hhold_{hdi})}$$

for the national weights, and

$$(17) \quad A_{ps\text{-}all}(phone\ status\ g, site, sample) = \frac{TOTHH_{\,g\text{-}site, sample}}{\sum_{resp\ \ hhold_i\ \ with\ phone\ status\ g\ in\ site, sample} WT_{interruption}(hhold_{hdi})}$$

for site-specific weights,

<>where *TOTHH* is the estimated number of all households in 2003 (for metro United States, nonmetro United States, or by site—for residual or new sample) by telephone status, and the

[11]These weights were used for low-intensity site-specific weights when combining with the rest of the RDD and field samples.

[12]To determine telephone status, we used the responses to question h32 ("During the past 12 months, was there any time when you did not have a working telephone in your household for two weeks or more?") and question h33 ("For how many...months...?").

denominator is the sum of the nonresponse- and telephone status-adjusted weights for all responding households in the corresponding category. *Phone status g* is equal to one (interruption in telephone service) or is equal to two (no known interruption in telephone service), $TOTHH_1 = TOTHH - TELHH$ and $TOTHH_2 = TELHH$ where $TELHH$ is the estimated number of telephone households in 2003.

The household-level weight poststratified to all households is:

(18) $$WT_{all}(hhold_{ghdi}) = WT_{interruption}(hhold_{hdi}) \cdot A_{ps\text{-}all}(phone\ status\ g).$$

g. Combining Weights from the Three Sample Components

In Round Four, we independently weighted the three sample components (overlap, residual, and new), then combined them in a way that accounted for the fact that telephone numbers in the overlap sample had a chance of coming into the sample as a residual case, and vice versa. We did this by applying constant factors to the overlap and residual samples after household-level poststratification, so that their weights then summed to the population, rather than to twice the population. This factor (.74 for the overlap sample and (1-.74) for the residual sample) was calculated based on the proportion of completed household interviews coming from the overlap sample (n = 15,047) versus the residual sample (n = 5,276). A factor of 1 was applied to the weights for the new sample, because it was the only sample component representing households with telephone exchanges in new working banks.

h. Interview Nonresponse Weight Adjustment for FIUs

The probability of selection of each FIU was equal to the probability of selection for its household (that is, all FIUs in a selected household were selected for the interview). We therefore used the final household weight as the starting point for developing the FIU weight.

The FIU weights accounted for FIU interview nonresponse within responding households. Within responding households, FIU eligibility was based on information that the household informant provided.

We started with an FIU-level file containing all FIUs enumerated within responding households and assigned to each FIU its final household weight. Using the same cells as defined for the telephone- and household-level adjustments, we created an FIU survey nonresponse adjustment factor for FIUs in responding households *i* (stratum *h*, Round Three disposition *d*):[13]

$$(19) \qquad A_{nr}(FIU_c) = \frac{\sum_{elig\ fiu \in c} WT(hhold_{hdi})}{\sum_{resp\ fiu \in c} WT(hhold_{hdi})},$$

where the numerator is summed over all eligible FIUs in cell *c*, and the denominator is summed over responding eligible FIUs in cell *c*.

An FIU weight adjusted for survey nonresponse was then calculated for these cases:

$$(20) \qquad W4(FIU_{hdi}) = WT(hhold_{hdi}) \cdot A_{nr}(FIU_c), \text{ if FIU responded}$$
$$W4(FIU_{hdi}) = 0, \text{ otherwise.}$$

i. Initial Person Weight

The probability of selection for each adult member of an eligible responding FIU was equal to the probability of selection of the FIU (that is, all adults in each responding FIU were selected for the interview). We therefore used the final FIU weight to develop the person weight for adults. However, because only one child was selected at random per FIU, the within-FIU

[13]To simplify notation, we use $WT(hhold_{hdi})$ here to refer to both national and site-specific household weights, weighted up to all households (WT_{all}) or weighted up to just telephone households (WT_{tel}). Parallel adjustments are made for all versions of these household weights.

probability of selection for a child was equal to the inverse of the number of children in the FIU. The overall probability of selection for person *k* in FIU *j* in household *i* in stratum *h* can be expressed as:

$$(21) \qquad P(person_{hijk}) = \frac{P(FIU_{hij})}{(\delta \cdot numkids_{hij}) + (1-\delta)},$$

where $numkids_{hij}$ is the number of children in FIU_{hij}, and δ is equal to zero for adults and is equal to one for children. So, the initial person-level weight for all people was calculated as follows:

$$(22) \qquad W5(person_{hdijk}) = W4(FIU_{hdi}) \cdot [(\delta \cdot numkids_{hij}) + (1-\delta)],$$

for all persons *k* in FIU *j*, household *i*, stratum *h*, with disposition *d*.

All eligible people in responding FIUs were assigned this weight, whether or not we had complete data on that person. Most of the survey data were obtained from the FIU informant about all family members; however, responses to subjective questions were obtained from a self-response module that each adult completed. Therefore, for some people, we had data that the FIU informant had provided but were missing data from that person's self-response module.

j. Nonresponse Adjustment to Person Weight

The next adjustment to the person weight accounted for high levels of missing data among people selected for the survey.[14] Four person records were deleted because of high levels of

[14]An editing program was used to determine whether a person record contained too many missing items to be usable. The editing rule was that all person records with 75 percent or more missing data for variables from Sections B through G of the questionnaire were considered to be nonrespondents.

missing information. This step in the weighting process adjusted for unit nonresponse at the person level, using the same weighting cells as defined for previous adjustments. We created a person-level survey nonresponse adjustment factor as follows:

$$(23) \qquad A_{nr}(missing_c) = \frac{\sum_{elig\ person \in c} W5(person_{hijkd})}{\sum_{resp\ person \in c} W5(person_{hijkd})},$$

for person *k* (in FIU *j*, household *i*, stratum *h*, disposition *d*) in cell *c*, where the numerator is summed over all eligible and selected individuals in cell *c*, and the denominator is summed over individuals with complete responses. A person weight adjusted for survey nonresponse was then calculated for these cases:

$$(24) \qquad W6(person_{hijkd}) = W5(person_{hijkd}) \cdot A_{nr}(missing_c),$$

if person met the editing rule for individuals

$W6(person_{hijkd}) = 0$, otherwise.

2. Calculating the Base Weight for National Estimates Using the Site Sample

In the previous section, we described the general weighting approach used for the RDD sample, including the initial sampling weight for each telephone number and adjustments to account for eligibility determination, nonresponse, and household-level poststratification. In this section, we show how the general approach is applied to the weight used when making national and site-specific estimates.

Weights used for making national estimates must account for the probability of selection of the site, as well as for the distribution of cases in the high-intensity and low-intensity sites. (The

selection of the 60 sites is discussed in detail in Metcalf et al. 1996 [Technical Publication 1 on HSC's website].) In Rounds One through Three, the sample size of RDD telephone numbers was about four times larger in the high-intensity sites than in the low-intensity ones. In Round Four, after reducing the target sample size for high-intensity sites, this factor was reduced to three. To account for the probability of selection of any telephone number when making national estimates, we used the expected number of selected telephone numbers in each site, $E(n_{sh})$, rather than the actual number of selected telephone numbers, n_{sh}. For site s in stratum h, where the site is an MSA with 200,000 or more people, the expected number of selected telephone numbers is:

$$
\begin{aligned}
(25) \quad E(n_{sh}) &= [n_{lo} \cdot 3 \cdot P(\text{high intensity})] + [n_{lo} \cdot P(\text{low intensity})] \\
&= [n_{lo} \cdot 3 \cdot 12/48] + [n_{lo} \cdot 36/48] \\
&= n_{lo} \cdot (3/4 + 3/4) \\
&= n_{lo} \cdot 1.5 \ ,
\end{aligned}
$$

where n_{lo} is the number of telephone numbers selected for a low-intensity site. For sites in small MSAs and for non-MSA sites, $E(n_{sh}) = n_{lo}$ because these sites had no chance of being selected as high-intensity sites.

When making national estimates, the combined site and telephone number probability of selection can then be defined as:

$$
(26) \quad PN_{hds}(telephone) = PSUPROB_s \cdot \frac{E(n_{sh})}{n_{sh}} \cdot P\left(case\ selected\ in\ R4, stratum\ h\right),
$$

where $PSUPROB_s$ is the probability of selection of site s [15] and n_{sh} is the actual number of telephone numbers selected in the site sample in stratum h in site s (set equal to n_{lo} for low-

[15] See Metcalf et al. (1996) for a detailed discussion of this probability.

intensity sites and equal to $3 \times n_{lo}$ for high-intensity sites, for the actual calculation). $P(\textit{case selected in R4, stratum } h)$ is the probability of selection of telephone numbers defined in Section 1.a. Formulas representing subsequent stages of selection, nonresponse adjustments, and poststratification used the reciprocal of this initial selection probability as their base weight. When making site-specific estimates, the probability of selection of the telephone number is $P(\textit{case selected in R4, stratum } h)$, as defined above.

C. WEIGHTS FOR THE FIELD SAMPLE

In this section, we describe the procedures used to construct final design-based weights for the survey's field component, which was designed to include households that had little or no chance of being selected for the RDD surveys. The field survey was not designed for independent use because of its limited coverage and small sample size. However, when combined with the site-based RDD survey, the field sample improves population coverage among subgroups less likely to be included in RDD-only surveys.

We produced two sets of weights for the field survey data. Although neither set is intended to be used alone in policy analysis, these two sets of weights and the weights representing the RDD sample were used to create integrated weights for making inferences about the entire U.S. population (excluding Alaska and Hawaii). Field sample weights for households, FIUs, and individuals were constructed for (1) individual sites in which the field survey was conducted, and (2) all MSAs with 1992 populations of 200,000 or more. We refer to the second set of weights as *national* weights. As with the RDD sample, each weight was the product of several factors that reflected differences in probabilities of selection and nonresponse. The set of weights (household, FIU, and person level) also included poststratification adjustments so that the sample matched external estimates of the relevant population.

1. Steps in the Weighting Process

The first weighting factor for a unit (listed housing unit [LHU], household, FIU, or individual) for any of the weights was the inverse of that unit's probability of selection.[16] This factor differed for site-specific estimates and national estimates. The weights also account for types of nonresponse at the household, FIU, or individual level and are ratio-adjusted to estimated population totals (poststratification).

a. Initial Weights

The initial weight was the inverse of the overall probability of selection of a unit. For a listed housing unit LHU_i in listing area LA_c in secondary sampling unit SSU_b and primary sampling unit PSU_a, the preliminary supplemental sample weight, *SWN*, is:

(32) $\mathrm{SWN}(\mathrm{LHU}_{i\in abc}) = 1/\mathrm{P}(\mathrm{LHU}_{i\in abc})$, where:

(33) $$P(LHU_{i\in abc}) = P(PSU_a)\cdot P(SSU_b \mid PSU_a)\cdot P(LA_c \mid SSU_b)\cdot P(LHU_i \mid LA_c).$$

The PSUs are the 12 high-intensity sites, secondary sampling units are areas within the sites selected with probability proportional to size within the sites, and listing areas were selected with equal probability within SSUs. The term $\mathrm{P}(\mathrm{LHU_i}|\mathrm{LA_c})$ accounts for the fact that only a subsample of listed housing units was selected for interviewing in some listing areas. For site-specific estimates, the same formula can be modified by omitting the term for the site selection probability $P(PSU_a)$. Thus, for site-level estimates for site *a*:

[16]We use the Census definition of a housing unit—that is, a structure that is occupied or intended for occupancy by person(s) living separately from other person(s) in the building and must meet one of the following criteria: (1) it has complete kitchen facilities for the exclusive use of that unit whether or not the kitchen is used; or (2) the housing unit has a separate entrance directly from the outside of the structure or through a common or public hall, lobby, or vestibule.

(34) $SWS(LHU_{i\in abc}) = 1/P_a(LHU_{i\in abc})$,

(35) $P_a(LHU_{i\in abc}) = P(SSU_b|PSU_a) \cdot P(LA_c|SSU_b) \cdot P(LHU_i|LA_c)$

For Round Four, we used the Round Three probabilities of selection, and then adjusted by a Round Four release rate (number of addresses released divided by the total number of addresses), accounting for supplemental listings.[17] Further adjustments to the field sample weights were carried out similarly to those for the RDD sample weights.

b. Adjustment to Field Sample Weight for Undetermined Residency

For the field weight, household level adjustments were made for whether (1) a sampled address was coded as an inhabited residence, (2) telephone status of a residence was determined, (3) survey eligibility was determined (defined the same way as for the RDD sample), and (4) the eligible household responded. These adjustments were done within weighting classes defined as each site.

To adjust for whether a sampled address was known to be an occupied housing unit, we created the following adjustment factor:[18]

(36) $$A'_{nr}(hhold_c) = \frac{\sum_{LHU_i \in c} SW(LHU_i)}{\sum_{det\ LHU_i \in c} SW(LHU_i)},$$

[17] Housing units in listed areas that had been missed in prior rounds or were perhaps newly constructed.

[18] To simplify notation, we switch from $SWN(LHU_{i\in abc})$ for national weights and $SWS(LHU_{i\in abc})$ for site-specific weights to $SW(LHU_i)$. Parallel adjustments are made for both versions of these weights.

where the numerator is summed over all addresses in cell (site) *c*, and the denominator is summed over addresses in cell *c* with a known residency status. An address weight, adjusted for determination of address eligibility, was then calculated for these cases:

(37) $W1(LHU_i) = SW(LHU_i) \cdot A'_{nr}(hhold_c)$, if eligibility of address determined
$W1(LHU_i) = 0$, otherwise.

After this adjustment, addresses with undetermined eligibility status and addresses known to be vacant or nonresidential were removed from the weighting process. The remaining addresses were those known to be households.

c. Adjustment to Field Sample Weight for Undetermined Telephone Status

Field sample households were screened to identify households that (1) did not have telephone service at the time we contacted them, or (2) had an interruption in telephone service of two weeks or more in the past 12 months. Households meeting either criteria were eligible for the field survey.

To adjust for whether a household's telephone status was known (that is, whether the telephone screening questions were completed), we created the following adjustment factor:

(38) $$A''_{nr}(nonphone_c) = \frac{\sum_{households \in c} W1(LHU_i)}{\sum_{det\ phone \in c} W1(LHU_i)},$$

where the numerator is summed over all known residential addresses in cell (site) *c*, and the denominator is summed over addresses in cell *c* with a known telephone status. A household weight adjusted for determination of telephone status was then calculated for these cases:

(39) $W2(hhold_i) = W1(LHU_i) \cdot A''_{nr}(nonphone_c)$, if telephone eligibility of household determined

$W2(hhold_i) = 0$, otherwise.

After this adjustment, households with undetermined telephone status and households with telephone service at the time of the interview and no interruption in service of two weeks or more during the 12 months before the interview were removed from the weighting process. The remaining households were those known to be without telephone service or meeting our telephone interruption criterion.

d. Survey Eligibility Nonresponse Adjustment to Household Weight in the Field Sample

After adjusting for undetermined telephone status, we used a weighting cell adjustment to account for households that (1) did not complete the survey enumeration questions to determine whether there was at least one civilian adult in the household, and (2) eligible households completing the enumeration questions that did not complete the survey.[19] To adjust for Round Four households with incomplete enumeration questions, we created the following household eligibility nonresponse adjustment factor:

$$(40) \qquad A'''_{nr}(hhold_c) = \frac{\sum_{nonphnhh \in c} W2(hhold_i)}{\sum_{det\ nonphn\ hh \in c} W2(hhold_i)},$$

where the numerator is summed over all nonphone households in cell (site) *c*, and the denominator is summed over nonphone households in cell *c* with known survey eligibility status. A household weight adjusted for determination of survey eligibility was then calculated for these cases:

[19]See Chapter II, Section F.1 for the definition of eligible and ineligible households and Chapter II, Section B.4 for a definition of individuals excluded from the survey.

(41) $W3(hhold_i) = W2(hhold_i) \cdot A'''_{nr}(hhold_c)$,if survey eligibility of household determined
$W3(hhold_i) = 0$, otherwise.

After this adjustment, households with undetermined eligibility status and households known to be ineligible for the survey were removed from the weighting process.

e. Interview Nonresponse Adjustment to Household Weight in Field Sample

We then adjusted these weights for survey nonresponse among eligible households. A responding household was one in which at least one eligible FIU responded to the survey.

We performed a weighting class adjustment for households using the same cells as defined for the household eligibility adjustment (see previous section). We created a household survey nonresponse adjustment factor as follows:

$$(42) \qquad A''''_{nr}(survey_c) = \frac{\sum_{elig\ hh \in c} W3(hhold_i)}{\sum_{resp\ hh \in c} W3(hhold_i)},$$

where the numerator is summed over all eligible households in cell *c*, and the denominator is summed over responding eligible households in cell *c*. The following household weight adjusted for survey nonresponse was then calculated for these cases:

(43) $W4(hhold_i) = W3(hhold_i) \cdot A''''_{nr}(survey_c)$, if the household responded
$W4(hhold_i) = 0$, otherwise.

f. Poststratification and Other Adjustments to Household Weight in Field Sample

Next, we poststratified the sum of the weights to estimated population totals. We used estimates of the proportion of nontelephone households in large MSAs from the March 2003 Supplement to the CPS (U.S. Census Bureau [http://www.bls.census.gov/cps/cpsmain.htm]). For

site-specific proportions of nontelephone households in each of the 12 high-intensity sites, we used data from the 2000 Census Long Form (U.S. Bureau of the Census 2002). For estimates of the number of nontelephone households (for large metro areas, and for each site), we used data from our sampling vendor (Marketing Systems Group-Genesys). The poststratification adjustment factor for nontelephone households is:

(44) $$A_{ps\text{-}nontel}(\text{large metro areas}) = \frac{NONTELHH}{\sum_{resp\ hh_i} W4(hhold_i)}$$ for national estimates, and

(45) $$A_{ps\text{-}nontel}(site) = \frac{NONTELHH_{site}}{\sum_{resp\ hh_i \in site} W4(hhold_i)}$$ for site-specific estimates,

where *NONTELHH* is the estimated number of nontelephone households in large metro areas of the United States in 2003. The household-level weight poststratified to nontelephone households is:

(46) $$WT_{nontel}(hhold_i) = W4(hhold_i) \cdot A_{ps\text{-}nontel} .$$

g. Nonresponse Weight Adjustment for FIUs in Field Sample

As with the RDD weighting adjustments, we developed the FIU weight for the field sample from the final household weight. The FIU weights accounted for secondary FIU nonresponse to the survey within responding households.[20] All FIUs in responding households were assumed to have known eligibility status.

[20]Secondary FIU nonresponse was less of an issue in the field sample than in the RDD sample because the household informant was allowed to respond on behalf of other FIUs in the household.

We started with an FIU-level file containing all FIUs enumerated within responding households and assigned to each FIU its final household weight. Using the same cells as defined for the telephone- and household-level adjustments (cells defined by site), we calculated the following adjustment factor as follows:

$$(47) \qquad A_{nr}(survey_c) = \frac{\sum_{elig\ fiu \in c} WT_{nontel}(hhold_i)}{\sum_{resp\ fiu \in c} WT_{nontel}(hhold_i)},$$

where the numerator is summed over all eligible FIUs in cell (site) *c*, and the denominator is summed over responding eligible FIUs in cell *c*. An FIU weight adjusted for survey nonresponse was then calculated for these cases:

$$(48) \qquad W5(FIU_i) = WT_{nontel}(hhold_i) \cdot A_{nr}(survey_c), \text{ if FIU responded}$$
$$W5(FIU_i) = 0, \text{ otherwise.}$$

i. Initial Person Weight

We used the final FIU weight to develop the person weight for adults in the field sample. However, because only one child was selected at random per FIU, the within-FIU probability of selection for a child was equal to the inverse of the number of children in the FIU. The overall probability of selection for person *k* in FIU *j* in household *i* can be expressed as:

$$(49) \qquad P(person_{ijk}) = \frac{P(FIU_{ij})}{(\delta \cdot numkids_{ij}) + (1 - \delta)},$$

where $numkids_{ij}$ is the number of children in FIU_{ij}, and δ is equal to zero for adults and is equal to one for children.

The initial person-level weight for all people was calculated as follows:

(50) $W6(person_{ijk}) = W5(FIU_i) \cdot [(\delta \cdot numkids_{ij}) + (1-\delta)]$.

All eligible people in all responding FIUs were assigned this weight, whether or not we had complete data on that person.

j. Nonresponse Adjustment to Person Weight

Using the same editing program and rule described previously for the RDD sample (see footnote 15), there were no person records in the field sample with high levels of missing information. Therefore, there was no person-level nonresponse adjustment.

D. INTEGRATED WEIGHTS FOR THE HOUSEHOLD SURVEY

The integrated weights combined the field and RDD survey data to make national and site-specific estimates. For areas represented by both the RDD and field components, the integrated weights accounted for the likelihood of being chosen in each of the two components. For areas not represented by the field component, the RDD survey data alone were weighted up to represent all households and people in those households, including those without telephones. We then used the following seven-step process to construct two sets of integrated weights (one set for national estimates and one set for site-specific estimates):

1. Poststratify the RDD and field components to our best estimates of the telephone and nontelephone populations, respectively (household level nonresponse-adjusted weights)
2. Create household telephone service interruption adjustment factors (IAFs) for both components
3. Apply IAFs to the weights for the two household components
4. Combine the RDD and field telephone components into one data file
5. Poststratify the combined RDD and field components again at the household level (recalibrate to maintain the correct number of households after these adjustments)
6. Apply the recalibrated IAFs to the weights for the two FIU components

7. Apply the recalibrated IAFs to the weights for the two person-level components

For national estimates, the field component represented nontelephone households in large MSAs only. For RDD site sample households in small MSA or nonmetropolitan strata, the "integrated" weights were the RDD weights representing all households in the strata *(WT_{all})*, where the weights of those with any telephone service interruption were inflated to account for the proportion of the year preceding the survey without service. The weights for these households were then poststratified to the estimated number of nontelephone households (by metropolitan status). The weights for households in the strata with no interruption were poststratified to the estimated number of telephone households.

For RDD households in the 48 large MSAs, we began with the weights that represented the telephone portion of the population *(WT_{tel})*. For the field households, we began with the weight that represented the nontelephone portion of the population. Large MSA households in the RDD component that had intermittent telephone service and households in the field component that had any telephone service during the year preceding the survey were adjusted for dual selection probabilities (they had a chance of being selected into both the RDD and field components), while accounting for the length of interruption. (This adjustment is described in more detail below.) Table V.2 illustrates how the RDD and field components were combined for national estimates.

For site-specific estimates, the field component represented nontelephone households in the 12 high-intensity sites only. For households in the low-intensity sites, the "integrated" weights represented all households *(WT_{all})*, where the weights of households with any telephone service interruption were inflated to account for the proportion of the year preceding the survey without service and poststratified to the estimated number of nontelephone households (by site). The

TABLE V.2

INTEGRATION OF RDD AND FIELD COMPONENTS FOR NATIONAL ESTIMATES BASED ON SITE SAMPLE

	RDD Component	Field Component
High-Intensity Sites	Represents households in large MSAs in contiguous United States with continuous or intermittent telephone service	Represents households in large MSAs in contiguous United States with intermittent or no telephone service
Other Large MSAs (Low-Intensity Sites)		
Small MSA Sites and Non-MSA Sites (Low-Intensity Sites)	Represents all households in balance of contiguous United States	

weights of cases with no interruption were poststratified to the estimated number of telephone households in the site.

For RDD households in the 12 high-intensity sites, we began with the site-specific weights that represented the telephone portion of the population *(WT_{tel})*. For the field households (all of which were in the 12 high-intensity sites), we began with the site-specific weight that represented the nontelephone portion of the population. High-intensity site households in the RDD component that had intermittent telephone service and households in the field component that had some telephone service during the year preceding the survey were adjusted for dual selection probabilities, while accounting for the length of interruption. Table V.3 illustrates how the RDD and field components were combined for site-specific estimates.

1. Telephone Service Interruption Adjustment Factor

A factor complicating the combination of the RDD and field samples was the inclusion of households with interrupted telephone service during the preceding year in both sample

TABLE V.3

INTEGRATION OF RDD AND FIELD COMPONENTS FOR SITE-SPECIFIC ESTIMATES BASED ON THE SITE SAMPLE

	RDD Component	Field Component
High-Intensity Sites	Represents households in sites with continuous or intermittent telephone service	Represents households in sites with intermittent or no telephone service
Other Large-MSA Sites (Low-Intensity)	Represents all households in site	
Small-MSA Sites (Low-Intensity)	Represents all households in site	
Non-MSA Sites (Low-Intensity)	Represents all households in site	

components. The integrated weights assumed that (1) households with no interruption in service could have been sampled only for the telephone survey, (2) those with no telephone service could have been sampled only for the field survey, and (3) the remainder could have been sampled for both surveys. For the RDD sample, 2.3 percent of households completing interviews had an interruption in telephone service of two weeks or longer during the year preceding the survey. For the field sample, 65.9 percent of households had some telephone service during the year preceding the survey and could have been sampled for the RDD survey.

Approximating probabilities of selection that accounted for multiplicity between the field and RDD sample frames was complicated by incomplete information on the addresses of some RDD households. Approximating these probabilities requires good address information to link the households to the Census block groups in which they resided. In addition, the data available to match RDD households to block groups were based on the 1990 Census and therefore could not have accounted for housing construction since then. Finally, the level of effort to complete such a match would have been substantial, and we concluded it was not cost-effective, given the

size of the samples eligible for inclusion in both surveys and the accuracy of the multiplicity estimates.

Instead, we constructed integrated weights that synthetically accounted for multiplicity by using a weighting adjustment that we termed the *telephone interruption adjustment factor* (the IAF). This factor accounted for both length of telephone interruption and multiplicity and was applied only to households in the "integration sites" (that is, sites represented by both the RDD and field components). For national estimates, integration sites included all 48 large MSA sites. For site-specific estimates, they included the 12 high-intensity sites only. For the RDD component, households with no telephone interruption would have been ineligible for the field component and so had an IAF set equal to one. For the field component, households with no telephone service would have had no chance of selection into the RDD component and also had an IAF equal to one. For households in the field component with some telephone availability and for households in the RDD component with some telephone interruption, we multiplied the value of IAF by the households' weights poststratified to the populations represented by their components (telephone or nontelephone). We calculated IAF_m as:

$$(51)\quad IAF_m = \frac{1/RelP_m}{1/MEDIAN(RelP)} . k \qquad m = (1,2,...,12),$$

where:

$$(52)\quad RelP_m = [PRatio . \frac{(12 - m)}{12}] + 1,$$

and

$$(53)\quad PRatio = \frac{\left(\text{unwgted hholds in RDD sample / telephone hholds in population}\right)}{\left(\text{unwgted hholds in field sample / nontelephone hholds in population}\right)},$$

where m is the number of months without telephone service; k is a constant used to inflate or deflate the adjustment so that the sum of the weights across the two components for households with an interruption in telephone service remained the same; $RelP_m$ is the relative combined likelihood of selection into either component, estimated on the basis of the number of months with telephone service; and *PRatio* is the probability of selection into the RDD component, relative to selection into the field component; and the "population" refers to either large metropolitan areas in the United States or to a high-intensity site.[21]

The IAF was then applied to the appropriate weight, depending on the sample component and length of telephone interruption, as follows:

(54) $WTINT_m = WT_{tel} \cdot IAF_m$, for RDD households in integration sites

(55) $WTINT_m = WT_{nontel} \cdot IAF_m$, for field households

(56) $WTINT_m = WT_{all}$, for RDD households outside of integration sites,

where m is the number of months without telephone service. For RDD households with $m = 0$ and for field households with $m = 12$, $IAF_m = 1$.

2. Poststratification of Person-Level Integrated Weights

For national estimates, person-level weights were poststratified by sex and age group, then by sex and whether or not Hispanic, then by sex and race (black or nonblack), then by level of education.[22] For high-intensity sites, site-specific weights were poststratified by age group, then

[21]In equation (52), the first term (in square brackets) represents the likelihood of selection into the RDD component, and the second term (the number 1) reflects the likelihood of selection into the field component.

[22]Age, sex, Hispanic, race, and education distributions and totals were from the March 2003 CPS (excluding Alaska and Hawaii).

by race/ethnicity (white, black, Hispanic, Asian), and the estimated site population.[23] Weights for low-intensity site-specific estimates were poststratified to site totals only. After person-level weights were trimmed, weights were poststratified again by the same demographic variables, as well as by the distribution of telephone and nontelephone households before trimming (discussed below). The re-poststratification was done within site for site-specific weights.

E. TRIMMING PERSON WEIGHTS

In analyses of survey data, even a few extremely large weights can reduce the accuracy of point estimates and inflate the sampling variance. To reduce the sampling variance, excessively large weights are trimmed, and the amount trimmed is distributed among the untrimmed weights to preserve the original sum of the weights. However, trimming of sampling weights can introduce bias into some point estimates. The objective in trimming weights is to reduce the impact of excessively large weights, while minimizing the introduction of bias.

For site-specific and national estimates, we trimmed the person- and family-level integrated weights and then assessed the effect of the trimming. We evaluated the extent of trimming and the inflation factor for the untrimmed weights necessary to preserve the original sum of the weights and then estimated the effect of the trimming on the sampling variance. We used a weight-trimming algorithm that compares each weight with the square root of the average value of the squared weight used to identify the trimming cutpoint and the weights to be trimmed. This algorithm has been referred to as the "NAEP procedure" (Potter 1990). The trimmed excess was distributed among the weights that were not trimmed.

[23]Age, race/ethnicity, and total population, by site, were based on figures from Marketing Systems Group-Genesys.

The statistical measure of the impact of the trimming was based on the design effect attributable to the variation among the sampling weights. Unequal weighting (a result of differential selection rates and response rates) has the potential to decrease precision because variation in the weights affects the variance of weighted estimates. Person-level weights were trimmed to reduce this design effect; however, the extent of trimming was limited to minimize the risk of introducing bias into the sample estimates.

Specifically, let WT_i denote a set of weights and let n denote the number of people. We first established trimming classes based on characteristics of the sample (the site) and the characteristics of the sample member (that is, adult or child). The weight-trimming algorithm establishes a cut-off point, T_c, in a trimming class, c, as:

$$(57) \qquad T_c = (k \sum_{i \varepsilon c} WT_i^2 \; / \; n_c)^{1/2},$$

where n_c is the number of observations in the trimming class, k is an arbitrary number (generally assigned a value of 10), and the summation is over the observations in the trimming class. Any weight exceeding the cut-off point, T_c, is assigned the value of T_c, and excess is distributed among the untrimmed weights, thereby ensuring that the sum of the weights after trimming is the same as the sum of the weights before trimming.

Using these newly computed weights, the cut-off point was recomputed and each weight again compared with the cutoff point. If any weight exceeded the new cutoff point, the observation was assigned the value of the new cutoff point, and the other weights were inflated to compensate for the trimming.

The cutoff point generated by the algorithm was generally used as the value of the trimmed weight. In some trimming cells, the algorithm indicated a trimming level that was judged to be

excessive, so a value larger than the computed cutoff point was used. In general, we used a larger value when the adjustment seemed excessive for weights that were less than the cutoff point or when a trimming class contained only a few observations. Our goal was to inflate the untrimmed weights by less than two percent.

The weights designed to produce site-specific estimates were evaluated for trimming separately for adults and children in each high-intensity site. Because only one child was randomly selected in each FIU and the sample size of children was smaller than that of adults, weights for children had greater variation and were larger on average than for adults. The weights for trimming were identified by using the NAEP procedure, as well as by visual inspection of outlier weights the NAEP procedure might have missed. The assessment of the impact of trimming was evaluated by inspecting the trimming level, the magnitude of the adjustment to the untrimmed weights, and the anticipated design effect from unequal weights.

We used a similar method to trim the weights designed to produce national estimates by using the NAEP procedure and assessing the impact of the trimming on the design effect from unequal weights. The weight-trimming classes were defined by the three site-selection strata (large MSAs, small MSAs, and non-MSAs), geographic region (four regions), and adult versus child.

FIU-level weights for site-specific and national estimates were also trimmed. We used the same trimming classes and procedures as were used for the two groups (adults and children) of person-level weights.

F. WEIGHT ADJUSTMENT FOR BAKER SYMPTOM RESPONSE MODULE

In Round Four, we introduced a new series of questions, referred to as the "Baker Symptom Response Module" (see Chapter III). All adults who were elderly (age 65 or older) or uninsured were asked this series. One-sixth of nonelderly insured adults were randomly selected to be

asked this series. To account for this random selection, we created a separate person-level weight (for national and site-specific estimates). This weight inflates the final (poststratified and trimmed) person-level weights of the selected nonelderly insured adults (the ones randomly selected at a rate of one-sixth) by six to account for all nonelderly insured adults, while setting the weights of those not selected (and children) to zero. The elderly and uninsured adults have their symptom response weights set equal to their final person-level weights. This will allow researchers who have access to the restricted use file (the only publicly released file that contains these weights) to make estimates based on this series of questions.

G. SAMPLING ERROR ESTIMATION

1. Background

Because the CTS Household Survey sample design is complex, it requires specialized techniques for estimation of sampling variances. Procedures in standard statistical packages, such as SAS and SPSS, compute variances using formulas under the assumption that the data are from a simple random sample from an infinite population. Although the simple random sample variance may approximate the sampling variance in some surveys, it is likely to substantially underestimate the sampling variance with a design as complex as that of the CTS Household Survey. Departures from a simple random sample design result in a design effect that is defined as the ratio of the sampling variance *(Var)* given the actual survey design to the sampling variance of a hypothetical simple random sample with the same number of observations. Thus:

$$(64) \quad Deff = \frac{Var\ (actual\ design\ with\ n\ cases)}{Var\ (SRS\ with\ n\ cases)}.$$

Based on the sampling variance, a series of measures of reliability can be computed for a parameter estimate or statistic. The standard error is the square root of the sampling variance.

Over repeated samples of the same size and using the same sampling design, we expect that the true value of the statistic would differ from the sample estimate by less than twice the standard error in approximately 95 percent of the samples. The degree of approximation depends on the distributional characteristics of the underlying observations. The relative standard error is the standard error divided by the sample estimate and is usually presented as a percentage. In general, an estimate of a population parameter with a relative standard error of 50 percent is considered unreliable and is not reported. Furthermore, an estimate with a relative standard error of greater than 30 percent may be reported but also may be identified as potentially unreliable.

For the CTS Household Survey, the sampling variance estimate, called the *design-based sampling variance,* is a function of the sampling design and the population parameter being estimated. The design-based variance assumes the use of fully adjusted sampling weights, which are derived from the sampling design, with adjustments to compensate for nonresponse and for ratio-adjusting the sampling totals to external totals (for example, to data on population totals by age and race/ethnicity generated by the Bureau of the Census from the CPS).

The data files for the CTS Household Survey contain a set of fully adjusted sampling weights and information on analysis parameters (that is, stratification and analysis clusters) necessary for the estimation of the sampling variance for a statistic. Because of the stratification and unequal sampling rates, it was necessary to account for the sampling weights and the sampling design features to compute unbiased estimates of population parameters and their associated sampling variances. The estimation of the sampling variance required the use of special survey data analysis software or specially developed programs designed to accommodate the population parameter being estimated and the sampling design.

Survey estimators fall into two general classes: (1) linear estimators, and (2) nonlinear estimators. Linear estimators are weighted totals of the individuals with an attribute, or means

and proportions, if the denominators are known (for example, when the denominator is a poststratum total or a sum of poststrata totals). Nonlinear estimators include proportions and means (when the denominators are unknown and are estimated from the survey), ratios, and correlation and regression coefficients. In general, the variances of nonlinear statistics cannot be expressed in a closed form. Woodruff (1971) suggested a procedure in which a nonlinear estimator is linearized by a Taylor series approximation. The sampling variance equation is then used on this linear form (called a *linearized variate*) to produce a variance approximation for the original nonlinear estimator.

Most common statistical estimates and analytic tools (such as percentages, percentiles, and linear and logistic regression) can be implemented using Taylor series approximation methods. Survey data software, such as SUDAAN (Shah et al. 1997), uses the Taylor series linearization procedure and can handle the multistage CTS Household Survey design, joint inclusion probabilities, and the stratification and clustering components of variance.

Other software packages use the Taylor series approximations (for example, Stata and SAS SurveySelect), but they do not account for the survey design as completely as does SUDAAN. For example, SUDAAN can take advantage of the high sampling rate in the site selection for the Household Survey, while accounting for unequal selection probabilities, and without-replacement sampling. The SUDAAN estimation algorithm incorporates a finite population correction factor. Failure to account for the finite population correction causes an overestimate of the variance for national estimates based on the site sample. Alternatives to using SUDAAN are discussed in Technical Publication 40 on HSC's website.

2. Variance Estimation

The CTS Household Survey contains weights that are designed for site-specific and national estimates. The site-specific weights are designed for estimates that include units (either FIUs or

individuals) from the site sample. The following discussion provides the variance estimation protocols for each of these weights. (The forthcoming Household Survey user's guide will provide instructions for deriving appropriate variance estimate for different samples.)

a. Site-Specific Estimate Weights

Variance estimation for site-specific estimates treats the sites as sampling strata. Within each of the 12 high-intensity sites, additional stratification was defined by RDD sample strata (two or three strata, depending on the site; see Table II.3) or as field sample. For the RDD sample, FIUs and individuals were treated as being clustered within households. For the field sample cases, the cluster was defined as the listing area. The samples were assumed to be selected "with replacement" in all strata.

b. Weights for National Estimates

As discussed previously, the 60 sites are a national probability sample. Nine of the sites were sufficiently large that they were selected with probability of 1.0 (that is, they were certainty selections). The remaining 51 sites were selected from among three strata: (1) MSAs with 200,000 or more people in 1992, (2) MSAs with fewer than 200,000 people in 1992, and (3) nonmetropolitan areas. The sites were selected with probability proportional to size within these strata, using a variation of the probability minimal replacement sequential selection procedure (Chromy 1979). Because the sampling rate of sites was sufficiently large and the Chromy sampling algorithm could be assumed, we used the finite population correction to improve the estimates of the sampling variances.

The finite population correction is a factor that accounts for the reduction in the sampling variance occurring when the sample is selected without replacement and a relatively large proportion of the frame is included in the sample. In an equal probability sample selected

without replacement, if 20 percent of the frame is included in the sample, then the value of the finite population correction is 0.80, and the estimated sampling variance is 80 percent of the sampling variance one would have obtained if the factor were ignored. For the Household Survey, the sampling percentage of sites was sufficiently high among the large MSAs, so we were able to use the finite population correction to obtain more accurate and smaller sampling variance estimates. We also used the finite population correction concept for the small MSAs, but not for the nonmetropolitan areas. For the nonmetropolitan areas, the sampling rate was sufficiently small that we assumed with-replacement sampling; thus, it was not necessary to use the finite population correction factor.

For the MSA sites, the samples were selected without replacement and with unequal probability. To account for the finite population correction, we computed the probability of selection of any pair of selected sites jointly into the sample. These joint inclusion probabilities and a site's probability of selection were used to compute the finite population correction factor using the Yates-Grundy-Sen variance estimation equation (Wolter 1985). The SUDAAN software package permits direct variance estimates based on this equation.

The stratification used in the variance estimation consisted of the following 20 analysis strata, also called *pseudostrata:*

- Nine analysis strata, one corresponding to each of the nine sites selected with certainty
- Nine analysis strata formed among the 39 noncertainty sites in the stratum of large MSAs (to facilitate the computation of the joint selection probabilities)
- One stratum for small MSAs
- One stratum for nonmetropolitan areas

In the nine analysis strata for the certainty selections, there was no first-stage variance component, and only a within-site variance component exists. For the noncertainty sample of MSAs, we assumed a two-stage design, with variance components at the first stage (assuming unequal probability and without replacement selection of the sites) and a variance component within the sites. For the nonmetropolitan sites, we assumed that the sites were selected with replacement; therefore, the variation among the first-stage units (the sites) accounted for the variance contribution from all stages of selection.

The within-site variance contributions were estimated for the 12 high-intensity sites using the stratification of the RDD sample and the field sample. In the low-intensity sites, the site sample was assumed to be a simple random sample with no stratification.

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