

Arthritis Conditions Health Effects Survey (ACHES) Data Documentation

Prepared by: KA Theis and L Murphy of the Centers for Disease Control and Prevention (CDC) Arthritis Program, based on: Manninen D, Cox BG, Christian J. Preparing for ACHES (Arthritis Conditions Health Effects Survey) Final Report, vol 1. Seattle, WA: Battelle; 2006. p. 1-110.(1)
The full report is available upon written request to the CDC Arthritis Program.

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Summary of Arthritis Conditions Health Effects Survey (ACHES)

1. Background

Arthritis and other rheumatic conditions are among the most prevalent chronic conditions in U.S. adults (2, 3) and are the most common cause of disability in the U.S. (4, 5). During 2007-09, an annualized estimate of 50 million U.S. adults reported doctor-diagnosed arthritis, and 21 million (42% of those with doctor-diagnosed arthritis) also had activity limitations caused by arthritis (6).

2. Survey objective

Surveys such as the National Health Interview Survey (NHIS) and Behavioral Risk Factor Surveillance System (BRFSS) provide basic information on the general health of the US population, including doctor-diagnosed arthritis. However, more detailed information on the psychosocial, work, physical functioning and activity, sleep, mood, and other impacts of arthritis is necessary to inform public health programs and policies. To address this need, in 2005-2006 the Centers for Disease Control and Prevention (CDC) Arthritis Program conducted the Arthritis Conditions Health Effects Survey (ACHES), a national random-digit-dialed telephone survey of noninstitutionalized U.S. adults ages ≥ 45 years, to generate a more comprehensive picture of the impact of arthritis on peoples' lives. ACHES, the first national survey dedicated to arthritis, used probability-based design and a stratified systematic sample of telephone numbers to collect data on 2,238 individuals ≥ 45 years who have doctor-diagnosed arthritis (or chronic joint symptoms but no arthritis diagnosis) and is designed to be representative of the ≥ 45 years civilian, noninstitutionalized population of the United States.

3. Survey Design

Battelle Centers for Public Health Research and Evaluation was contracted to develop the ACHES sampling design and to administer ACHES interviews; all contractor activities were reviewed by CDC. ACHES, which is based on a probabilistic sampling design, was designed to be representative of the U.S. population ages ≥ 45 years with self-reported doctor-diagnosed arthritis (hereafter arthritis) (or chronic joint symptoms but no arthritis diagnosis) living in civilian, noninstitutional housing in the United States.

Adults were defined as having arthritis if they responded 'yes' to the standard CDC surveillance case-definition for arthritis: "Have you ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?" A clinic-based validation study found this question had high positive predictive value for arthritis diagnosis (74.9 for 45-64 years; 91.0 for ≥ 65 years) (7). Individuals with chronic joint symptoms but no diagnosis of arthritis were identified by report of pain, aching, or stiffness in or

around a joint (other than the back or neck) that first began at least three months prior to the survey and a 'no' response to the arthritis case-finding question.

At the time the survey was being designed, there was ongoing investigation into differentiating those with arthritis (who may or may not have chronic joint symptoms) and those with chronic joint symptoms but no arthritis diagnosis. The main focus of the survey was on respondents with arthritis; however, data were also collected from people with chronic joint symptoms but no arthritis diagnosis. During the course of the ACHES survey, results from another validation study suggested that very few individuals with chronic joint symptoms but no arthritis diagnosis actually have arthritis (8). CDC strongly recommends that data for respondents with arthritis are analyzed separately from those with chronic joint symptoms but no arthritis diagnosis because they appear to be disparate populations. This document, therefore, describes survey activities targeting people with arthritis, unless otherwise noted.

The sampling frame for this survey was derived using a list-assisted, random-digit-dialed (RDD) telephone sample approach. Telephone numbers in the sampling frame were partitioned into seven strata based upon characteristics of the Census block linked to the telephone number, and a systematic sample of telephone numbers was selected from each of the seven strata. These strata were defined based upon the proportion of Hispanics and non-Hispanic (NH) blacks in the strata per U.S. Census data with the purpose of ensuring that the probability of selecting a telephone number in a stratum with a high proportion of Hispanics and/or NH blacks was equal to selecting a number in a stratum with a high proportion of whites. Response rates among Hispanics and NH blacks are reported to be lower than whites (9). The purpose of ACHES was to provide data to generate estimates that are representative of the US population of people with arthritis; therefore, including strata with disproportionately higher Hispanics and/or NH blacks increased the likelihood that the results from this sample are representative of the target population. Within each stratum, telephone numbers were sorted by the ten Census divisions and metropolitan status (i.e., urban versus rural counties) and were selected with equal probability across these groups to ensure geographic representation and to reduce sample variation within each stratum. Telephone numbers were then selected systematically from each stratum.

A sample of 52,014 telephone numbers was selected from the Genesys Sampling Systems listing of telephone number banks with at least one listed number allocated for residential service. (These banks are called *hundred-number banks* because they represent the first eight digits of the ten-digit telephone number and can, therefore, be linked to 100 unique telephone numbers.) The sample of phone numbers was processed in replicates (representative subsamples of the larger population). Data from the first two replicates were used to project the eligibility and completion rates for each of the seven strata. Numbers were prescreened by Genesys to remove easily identifiable nonresidential numbers and cell phones (25,543 numbers). Trained telephone interviewers dialed the remaining 26,471 numbers to ascertain whether they reached a non-institutional residence (i.e., household) (Figure 1). Protocol called for two sets of screening

questions to be applied to each successfully dialed number. The first set of screening questions ascertained whether there was at least one age-eligible individual in the household. The second set of screening questions determined arthritis-status eligibility. After successfully meeting criteria of both sets of screening questions, the ACHES study questionnaire was administered. More than one case per household was allowed. Interviews were completed with 1,793 individuals with arthritis (including 114 Hispanics and 206 NH blacks) [2,238 total interviews were completed (i.e., 445 respondents had chronic joint symptoms but no arthritis diagnosis and are outside the scope of this document)].

4. Questionnaire Development

While developing the ACHES questionnaire, CDC Arthritis Program staff consulted arthritis experts across a diverse mix of disciplines and viewpoints to obtain recommendations on the research questions and knowledge gaps that the ACHES survey should address, including target population, the domains to be addressed, and specific questions to be included. Five topic-specific conference calls were held with arthritis experts to elicit recommendations on questions to use for measuring the following domains:

- (1) knowledge, attitudes, and beliefs about arthritis, as well as sources of information/information seeking;
- (2) questions to be asked of those with chronic joint symptoms but no arthritis diagnosis;
- (3) pain/disability/function/mental health;
- (4) self-management (beliefs, behaviors, and barriers); and
- (5) reports of receiving clinical recommendations regarding self-management.

The ACHES questionnaire was developed in stages. Battelle conducted internal testing of proposed sections during development of a draft survey instrument. Following internal testing of the draft questionnaire, the sections were revised to reduce the survey length (including screening and eligibility questions) to between 20 and 30 minutes to improve response rates and to facilitate telephone administration of the survey to the elderly portion of the target population. Nine adults (ages 48-81: six females; 3 males: two black, 1 Hispanic, and 6 NH/non-black) pre-tested the revised questionnaire, which took between 17 and 32 minutes to complete.

The screening questions and the ACHES questionnaire were translated by Research Support Services (RSS) of Evanston, Illinois for administration to Spanish-speaking respondents. By using a committee approach to translation, the goal was a linguistically equivalent and culturally appropriate version of the original ACHES instrument that would work well for people who speak different varieties of Spanish. The final version of the questionnaire required consensus among the three translators, each of whom were native Spanish speakers from different regions (Mexico, Puerto Rico, and South America), and a referee with extensive experience in survey instrument translation.

ACHES included questions from several other surveys (e.g., NHIS, BRFSS, HealthStyles). The sources of the questions in the ACHES questionnaire are summarized in Table 1.

Table 1. Sources of Questions in ACHES

<i>Section*</i>	<i>ACHES Question† (reference)</i>	<i>Source‡</i>
<i>Arthritis screening</i>	<i>ASCR1-2(10) ASCR3(11) ASCR4(10),(12) ASCR5(13)</i>	<i>BRFSS; NHIS 2001</i>
<i>General function</i>	<i>GF1(modified)(14) GF2(10), (12) GF3(modified) (15),(16)</i>	<i>BRFSS; NHIS 2002; MDHAQ; AIMS2</i>
<i>Symptoms</i>	<i>SX1 SX2 (modified)(12) SX3-4 (modified) (17) SX5</i>	<i>New; NHIS 2002; ACR-20</i>
<i>Physical Functioning Scale (SF-36v2)</i>	<i>SF1-10 (18)</i>	<i>SF36V2; (SF12 used)</i>
<i>Work effects</i>	<i>WK1(19) WK2-4 (modified)(10),(12) WK5-9</i>	<i>BRFSS; NHIS 2002 (question broken into 3 parts); New</i>
<i>Interference</i>	<i>INT1 INT2-4 (20) INT6</i>	<i>ACR20; Variants of Lorig Social/Role Activity Limitations questions; SF-12 variant</i>
<i>Attitudes</i>	<i>ATT1-5 (21)</i>	<i>HealthStyles (Unpublished)</i>
<i>Confidence</i>	<i>CON1-4 (21)</i>	<i>HealthStyles (Unpublished)</i>
<i>Self-management</i>	<i>SM1 SM2(22) SM3-4</i>	<i>New; BRFSS</i>
<i>Stage of change for physical activity</i>	<i>SOC1-4 (modified) (23)</i>	<i>Marcus et al.</i>
<i>Physical activity</i>	<i>PA1-6(11, 24)</i>	<i>BRFSS; New</i>

	<i>PA7</i>	
<i>Arthritis</i>	<i>ARTH1-(modified) (12)</i> <i>ARTH2</i> <i>ARTH3(11)</i> <i>ARTH4-5</i>	<i>NHIS 2001; New; BRFSS; New</i>
<i>Clinical care</i>	<i>CC1(modified)(13)</i> <i>CC4-5(22), (12)</i> <i>CC6 (modified)(22)</i> <i>CC2-3</i>	<i>BRFSS; New</i>
<i>Demographics</i>	<i>DEM1(19)</i> <i>DEM2(25)</i> <i>DEM3 (modified)(25)</i> <i>DEM4-5(modified)(19)</i>	<i>BRFSS</i>
<i>Mood</i>	<i>MOOD1-12 (26, 27)</i>	<i>AIMS</i>
<i>Help seeking</i>	<i>HELP1</i> <i>HELP2-5</i>	<i>New</i>

* Sections correspond to the layout of the ACHES survey; items from the five domains identified in questionnaire development are interspersed throughout the survey

† The ACHES questionnaire in its entirety is provide in Appendix A

‡ Copyright may apply (e.g., SF questions)

BRFSS = Behavioral Risk Factor Surveillance System (19);

NHIS = National Health Interview Survey (12);

MDHQ = Multidimensional Health Assessment Questionnaire (28);

ACR 20 = American College of Rheumatology 20% improvement criteria (17);

SF36V2 = Short Form 36, version 2 (18);

SF12 = Short Form 12;

AIMS =Arthritis Impact Measurement Scales (26)

New = newly developed question

5. Survey Administration

ACHES interviews were conducted from Battelle’s Baltimore, Maryland and Seattle, Washington telephone centers to provide the most comprehensive coverage of samples across time zones as was possible and the most convenient interview times. Prior to data collection, interviewers underwent a 2-day training session followed by practice, role plays, and certification.

An advance letter (in both English and Spanish) was sent to the addresses that were available for the telephone numbers from the Genesys list-assisted sampling frame (~50% of telephone numbers had valid addresses). Interviewer staff administered the survey using a Computer

Assisted Telephone Interview (CATI) system to: 1.) determine the presence of one or more adults ≥ 45 years in the household, 2.) screen the age-eligible adult to identify those with arthritis, 3.) administer the ACHES questionnaire, and 4.) to repeat steps 2 and 3 with the remaining age-eligible adults with arthritis in each household. Survey completers were offered a choice of incentives—either a \$5 long-distance calling card or a \$5 donation to the Arthritis Foundation.

The first serious threat to response rates is associated with establishing contact with an adult member of the household. Establishing such contact required that the telephone number be called when an adult was present and that he or she picked up the phone. In order to maximize the chances that the telephone rang while an adult was home, call scheduling was varied over a sequence of days of the week and time within days.

The telephone interviews were conducted from June 6, 2005 – April 8, 2006. For each sampled telephone number, data collection occurred at the telephone number/household level for the first available member ≥ 45 years (if any) and then for all other members ≥ 45 years (again if any). At the telephone number/household level, the interviewer first determined if the telephone number was residential and then if the household contained one or more individuals ≥ 45 years. The first respondent who was ≥ 45 years was screened for arthritis, and the questionnaire was administered to those who met both age and disease criteria. After screening and/or interviewing the first age-eligible participant, the interviewer determined if there were additional age-eligible household members and attempted to interview remaining eligible residents.

Throughout ACHES data collection, results were monitored based on the most recent disposition code assigned to each telephone number. The disposition codes corresponded to what steps in data collection had been completed for each sampled telephone number (Figure 1). This information was used in calculating the nonresponse adjustment for completed cases. Council of American Survey Research Organizations (CASRO) guidance and criteria were used in all response and completion rate calculations (29).

6. Response Rates

Sample selection and response rate calculations are presented for all ACHES participants combined (i.e., those with arthritis and those with chronic joint symptoms but no arthritis diagnosis) because these numbers are not available separately for the two subgroups (Figure 1). Interviewing began with the selection of the list-assisted sample of 52,014 telephone numbers by Genesis Sampling Systems. Genesys prescreened the sample by calling numbers to identify ineligible numbers (e.g., nonworking numbers, nonresidential numbers, cell phones). A total of 26,471 (50.9%) of the sampled numbers remained after Genesys prescreening. Of the 26,471 numbers that were dialed to determine their residential status, Battelle interviewers were able to determine the residential status of 22,758 (86%) of the numbers dialed. Of these 22,758

numbers, 16,009 (70%) were determined to be residential numbers, and 6,749 (30%) were determined to be nonresidential numbers.

Having determined that a number was working and residential (i.e., a household), the interviewer next attempted to determine whether the household was eligible for the study—that is, whether it contained at least one member ≥ 45 years. Household eligibility was determined for 9,479 of the 16,009 (59%) numbers that were determined to be residential. Of the 9,479 numbers completing the household eligibility screener, 5,538 (58%) were determined to have at least one member age ≥ 45 years. After the interviewer determined that a household was eligible, the interviewer attempted eligibility screening with all household members age ≥ 45 years. Of the 5,538 eligible households identified as containing at least one age ≥ 45 years member, 4,320 (78%) provided information on the total number of persons ≥ 45 years in the household. Of the 4,320 households providing data on the total number of age-eligible household members, 2,665 (62%) had only one age-eligible member and 1,655 (38%) had two or more members ≥ 45 years. (Figure 1.)

Interviews were attempted with all persons ≥ 45 years residing in the household. When the first age-eligible household member came to the telephone, the interviewer asked a series of screening questions (see Appendix A) to determine if that person (Person 1) had been diagnosed with arthritis by a health care professional. From the 5,538 eligible households with at least one age-eligible member, the interviewers completed screening with 4,542 (82%) of these Person 1's. Of the 4,542 Person 1's completing the screen, 2,535 were identified as both age-eligible and condition-eligible—for a Person 1 screening eligibility rate of 56%. Of the 2,535 Person 1's who were identified as study-eligible, 1,912 (75%) completed the interview. The interviewer determined the total number of age-eligibles in the household after data collection was finished for Person 1. A total of 1,655 households reported more than one age-eligible, leading to data collection being attempted for 1,702 additional age-eligible household members (Person 2+'s). The interviewers completed screeners with 866 (51%) of the 1,702 Person 2+'s. Of the 866 Person 2+'s completing the screener, 409 were identified as both age-eligible and condition-eligible—for a Person 2+ screening eligibility rate of 47%. Of the 409 Person 2+'s who were identified as study-eligible, 326 (80%) completed the interview. (Figure 1.)

CASRO response rates were calculated for households, Person 1's, and Person 2+'s, and then for all study-eligibles. CASRO response rates are defined as the number of completed interviews with study-eligibles divided by the total number of eligibles in the sample. Eligibles include both eligible individuals identified during data collection and unidentified eligible individuals among the nonrespondent households or individual household members. In calculating response rates, the conventional assumption that nonrespondents at each step had eligibility rates similar to the respondents from the same stratum was made. For all except the overall person-level response rate, the conventional formula for the CASRO response rate can be shown to be algebraically equivalent to the product of the completion rates for each data collection step.

The CASRO response rate at the household level was 51% for identifying household eligibility (i.e., at least one age-eligible resident), which was derived as the product of the residential status completion rate (86%) and the household eligibility screening completion rate (59%).¹ The estimated (unweighted) response rate for age-eligibles was 40% for determining total age-eligibles within the household, which was derived as the product of the residential status completion rate (86%) and the household eligibility screening completion rate (59%) and the total age-eligibles screening rate (78%). The CASRO response rate at the Person 1 level was 31%, which was derived as the product of the household-level response rate (51%) and the Person 1 screening rate (82%) times the Person 1 interview completion rates (75%). Similarly, the CASRO response rate for Person 2+'s was 16%, which was derived by multiplying the response rate for the determination of total study-eligibles in the household (40%) by the Person 2+ screening rate (51%) times the Person 2+ interview completion rate (80%). (Figure 1.)

For the overall person-level response rate, both weighted and unweighted CASRO response rates were calculated. The CASRO response rate at the overall person level is not algebraically equivalent to the product of completion rates. Accordingly, the overall CASRO response rate formula was derived from first principles. The numerator was the total completed interviews with study-eligibles across Person 1 and Person 2+. The denominator was the estimated total survey-eligibles associated with all sampled numbers, including the nonrespondents for whom survey eligibility was undetermined. This total was derived as the sum of:

- The total study-eligibles identified among Person 1's and Person 2+'s who completed study screening.
- The estimated study-eligibles from those persons not completing the study eligibility screening—calculated as the total study screening nonrespondents of each person type times that person type's (1 or 2+) study eligibility rate.
- The total eligible Person 2+'s in eligible households known to contain one age-eligible but with the total number of age-eligibles unknown—calculated as the product of eligible households with unknown total age-eligibles times the estimated fraction of eligible households with more than one age-eligible times the average number of additional age-eligibles in households with multiple age-eligibles times the eligibility rate for Person 2+'s.
- The total eligible Person 1's in households where we did not determine if an age-eligible was present—calculated as the product of the total households with unknown eligibility times the household eligibility rate times the Person 1 eligibility rate.
- The total eligible Person 2+'s in households where we did not determine if an age-eligible was present—calculated as the product of the total households with unknown eligibility

¹ The computations to derive the response rates were made using the more precise unrounded values of the completion rates so the product of these rounded completion rates will not exactly equal the response rates shown here and elsewhere.

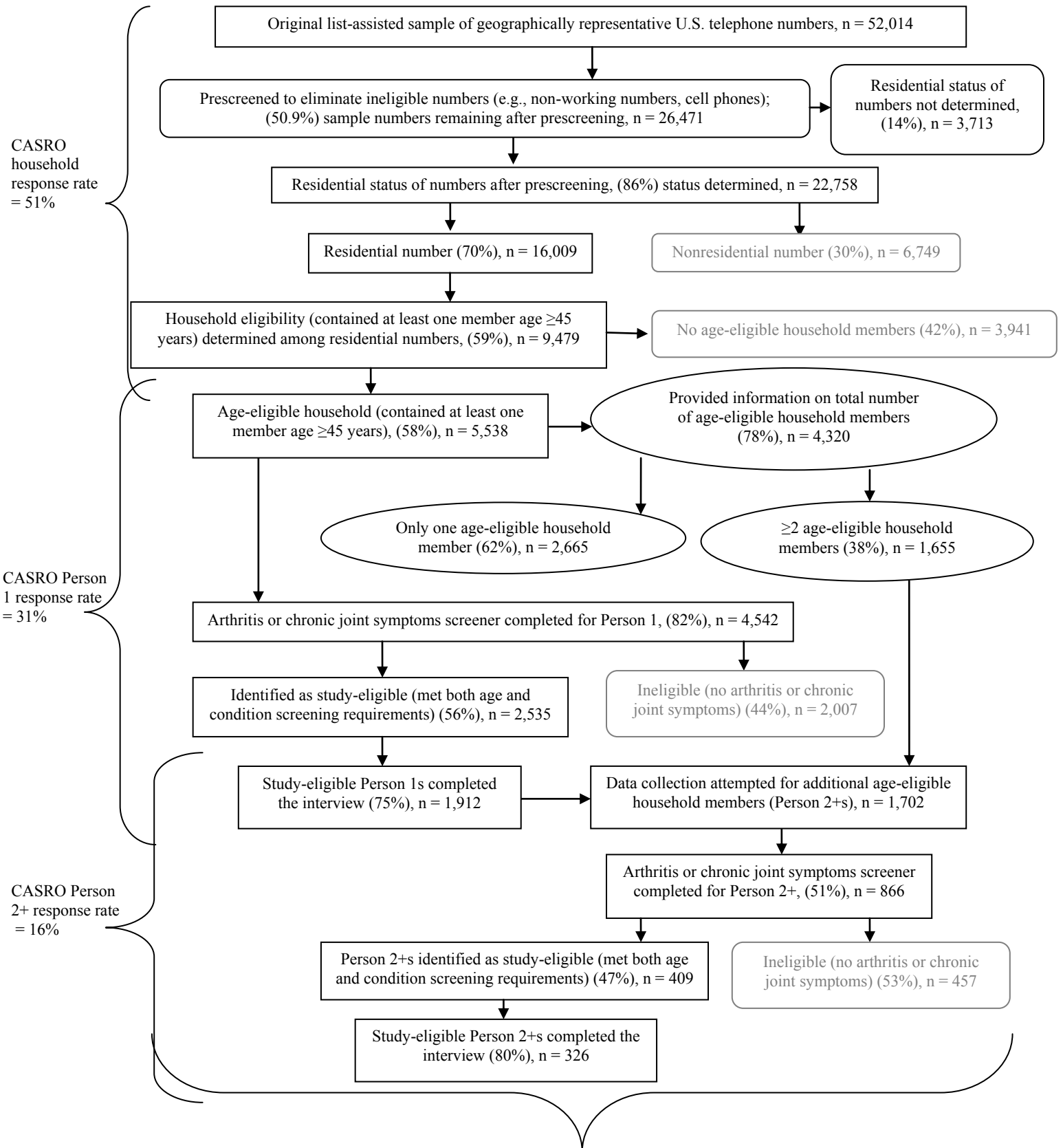
times the household eligibility rate times the fraction of eligible households with multiple members times the average number of Person 2+s in households with multiple members times the Person 2+ eligibility rate.

- The total eligible Person 1's in households where residential status was not determined—calculated as the product of the number of telephone numbers with residential status unknown times the residential eligibility rate times the household eligibility rate times the Person 1 study eligibility rate.
- The total eligible Person 2+'s in households where residential status was not determined—calculated as the product of the number of telephone numbers with residential status unknown times the residential eligibility rate times the household eligibility rate times the fraction of eligible households with multiple members times the average number of Person 2+s in households with multiple members times the Person 2+ eligibility rate.

Weighted rates were calculated in the same way as the unweighted rates but all computations were weighted by the sampling weights of each sampled telephone number.

The overall person-level unweighted response rate was 28%, and the overall person-level weighted response rate was 29%. The sampling weights used to derive the weighted response rates were uniform within strata, so the weighted and unweighted rates within strata are equal. Completion rates varied across strata with the lowest rates observed for the two high minority strata and the highest rates for the low minority stratum. The weighted response rate, which is slightly higher than the unweighted response rate, reflects the fact that the high minority concentration strata were sampled at higher rates (a smaller weight) but responded at a lower rate than the low minority strata.

Figure 1. Telephone Number Disposition and Response Rate Calculations



7. Sample Weighting and Nonresponse Adjustment

Sampling weights were calculated so that ACHES data could be used to make inferences about U.S. adults ≥ 45 years with arthritis. This section describes the calculation of the initial sampling weights and adjustments for 1) nonresponse to determining residential status and household eligibility, 2) inability to determine the total number of age-eligibles within households known to contain study eligibles, 3) person-level screening and interview nonresponse, and other steps in developing weights (e.g., adjusting for differential probabilities associated with multiple telephone lines and poststratification adjustment to compensate for undercoverage of nontelephone households).

Sampling weights were calculated to reflect the differential probabilities of selection across strata and to compensate for the potential biasing effect of survey nonresponse and undercoverage. The weight of a sampled age-eligible adult with arthritis can be viewed as the number of such adults in the target population that the sampled adult represents. The weighting process began by constructing sampling weights as the inverse of the probability of selection of the sampled telephone number.

These sampling weights were then adjusted in multiple steps to account for sampled telephone numbers from which we did not receive a complete response. The nonresponse adjustments attempted to correct for the following types of nonresponse:

1. Telephone numbers whose residential status was unknown
2. Residential numbers for which the presence of age eligibles was unknown
3. Person 1's for whom study eligibility was unknown
4. Person 1's who did not complete the interview
5. Residential numbers for which the presence of additional age eligibles was unknown
6. Person 2+'s for whom study eligibility was unknown
7. Person 2+'s who did not complete the interview

The Person 1 nonresponse-adjusted weight corrected for nonresponse of types 1, 2, 3 and 4. The Person 2+ nonresponse-adjusted weight corrected for nonresponse of types 1, 2, 5, 6, and 7. Both sets of weights were also adjusted to reflect multiple selection opportunities associated with multiple telephone lines. To correct for undercoverage associated with lack of telephone service, these person weights were raked (a statistical adjustment used to reduce nonresponse and noncoverage biases, as well as sampling variability) to marginal totals for race/ethnicity by gender by age counts of persons with arthritis and persons with chronic joint symptoms but no arthritis diagnosis, both of which were derived from the 2003 to 2005 National Health Interview Survey (NHIS). Raking is an iterative process that successively adjusts the weights so that they yield each separate set of population totals and then repeats the process until weights are created that reproduce each set of population counts used in the raking process. The weights for persons with doctor-diagnosed arthritis were successively raked to the composite NHIS population totals for race/ethnicity by sex and for race/ethnicity by age. The weights for persons with chronic joint symptoms but no arthritis diagnosis were raked to the composite NHIS population totals for race/ethnicity, for age, and for sex.

The distribution of the resultant weights were examined within race/ethnicity by arthritis versus chronic joint symptoms but no arthritis diagnosis to determine whether there was an unnecessarily large unequal weighting effect associated with variable weights; none were found. No adjustments were made to the poststratified arthritis weights, and these became the final analysis weights. The weights for those with chronic joint symptoms but no arthritis diagnosis were truncated to reduce the range of the weight distribution within each race/ethnicity group. The truncated weights were again raked to the NHIS-derived counts of persons with chronic joint symptoms but no arthritis diagnosis to recover the lost weight associated with the truncation to produce the final analysis weight for chronic joint symptoms but no arthritis diagnosis. The final analysis weights differentially weight the study respondents to reflect the disproportionality in the final sample relative to the population of interest.

8. Survey Strengths and Weaknesses

ACHES was a complex random-digit-dialed survey that collected data from respondents across the United States who have arthritis or chronic joint symptoms but no arthritis diagnosis. The survey was administered via the Blaise® call scheduling CATI system. Detailed and standardized calling procedures were established prior to conducting ACHES to maximize response rates. Strengths and weaknesses of ACHES from a survey perspective are summarized in Table 2.

Table 2. Strengths and Weaknesses of ACHES (1)

Survey Attribute	Strength	Weakness	Comment
Survey objective			
Target population of adults ≥ 45 years with arthritis	Restricting the target population to adults ≥ 45 years minimized the number of ineligible adults who were screened for arthritis, reducing burden and study costs	Cannot use study results to make inferences to the total adult population (ages 18+) with arthritis	ACHES captures a representative sample of adults ≥ 45 years with arthritis
Nationally representative probability sample of 1,793 completed interviews with adults ≥ 45 years with arthritis	Sample provides a defensible basis for inference from the sample to the target population	Small sample size may limit capability for inferences about small subpopulations	ACHES data will provide a unique look into the impact that arthritis has on adults ≥ 45 years
Survey design			
Stratification by race/ethnicity	Allowed oversampling of telephone numbers likely to be associated with minority households	Response rates differed across strata with lowest rates for high minority strata	Future studies may want to identify strategies for improving response rates among minorities.

Survey Attribute	Strength	Weakness	Comment
SF36 standard questions used and screening questions modeled after NHIS questions on arthritis with English and Spanish versions	Analysts can compare findings across surveys using the same questions	An independent Spanish translation was used rather than standard translation (<i>contractor error</i>)	The differences in translations only affect those Hispanics who were interviewed using the Spanish questionnaire (n= 45)
Survey administration			
Advance letter	Provided an opportunity to educate households as to survey legitimacy and encourage cooperation	Usable addresses were only available for about half of sampled numbers	The advance letter did not seem to garner much participation from respondents
Bi-coastal data collection	Collecting data from Baltimore and Seattle call centers allowed contractor to maximize calling patterns	Monitoring interview performance across two calling locations required more attention to detail	Worthwhile to use two bi-coastal calling centers but not essential
List-assisted telephone sampling frame	Widely used and inexpensive frame that covers households with listed and unlisted telephone numbers	Adults living in households without telephone service are not included in the frame	About 95% of all households had landline telephone service in 2005-6, suggesting study undercoverage is low and can be compensated for in sample weighting
Multi-stage calling protocol	Allowed cases to receive calls varied by time of day and day of the week. Ensured appropriate number of calls were made based upon the stage of interviewing completed to date for that number	Required more calendar time to ensure proper sequencing of calls	Allowed cases to be worked thoroughly following call patterns favored by survey methodologists
Random-digit-dialed telephone data collection mode	Far less costly data collection than for face-to-face interviews and national samples possible with acceptable coverage	Establishing contact is difficult as is gaining cooperation for these cold contact calls to sampled households	More attention is needed to determine the most effective call scheduling patterns and how to motivate households to respond while preserving their right to decline participation
Bilingual interviewing (Spanish)	Spanish speaking interviewers were assigned to households identified as requesting or requiring an interview in Spanish	The initial screening of high minority strata was typically done by an English-only interviewer	It would be preferable to use a bilingual interviewer to process telephone numbers from strata with large percentage Hispanics

Survey Attribute	Strength	Weakness	Comment
Interviewing all study eligibles in sampled households	Interviewing all study eligibles in households with multiple adults ≥ 45 years reduced the number of households that had to be screened	Completion rates for subsequent age eligibles were less than those for first age eligible household member; lack of independence of these respondents was accounted for statistically to preserve analytical assumptions.	Higher completion rates for first household age eligible may have been attributable in part to the interviewer being encouraged to begin interviewing with the most convenient and cooperative age eligible member
Total age eligibles requested after interview with first age eligible finished	Interviewing should convince respondent of the legitimacy of the study	Interviewing was done sequentially with subsequent interviews not started until first person completed. CATI programming was more complicated.	It might have been more efficient to ask for the total number of adults ≥ 45 years before beginning study screening
Response rates			
Response and eligibility rates	Eligibility rates estimated for the survey (percentage of households with age 45+ members, percentage of age 45+ adults with arthritis) were quite close to similar rates calculated from large-scale national surveys such as the NHIS	Overall response rate was low at 29%, with losses more pronounced for Hispanics and non-Hispanic blacks	Weighting procedures were implemented to reduce the impact of the low response rate and any associated nonresponse bias
Data collection field period from June 2005 to April 2006	Longer than usual field period allowed us to start slowly and adapt interviewing procedures as needed	Interviewer turnover was more frequent because of longer commitment required	Given the complex nature of the interviewing process, additional time and funding might have improved response rates
Sample weighting and nonresponse adjustment			
Detailed disposition codes used	The disposition codes recorded the progress made in completing interviewing operations for households and individuals and captured the data needed for weighting	The cause of nonresponse, such as repeated calls with only answering machines, was not always clear	The final disposition codes might be modified to record common sources of nonresponse while still capturing the progress made in completing the interviewing operations

Survey Attribute	Strength	Weakness	Comment
Sampling weights and nonresponse adjustments	Sampling weights accounted for differential selection probabilities across strata. Weighting class adjustments corrected for response differences by stratum and Census region. Post-stratification adjustments forced weight totals to NHIS composite population totals for people with arthritis and also corrects for undercoverage of nontelephone households	A minor loss in precision due to the unequal weighting associated with sampling and nonresponse adjustments	The final analysis weights were designed to facilitate separate analyses for people with arthritis and for people with chronic joint symptoms but no arthritis diagnosis
Donation			
Monetary Incentive or Charitable Contribution	Respondents were offered a telephone card as an incentive for completing the interview or a \$5 donation would be made to the Arthritis Foundation.	Survey literature suggests that incentives are most helpful in encouraging response when they are paid prior to the first contact, which was not feasible for this survey	Respondents who completed the survey seemed appreciative that an incentive was being offered and impressed that we gave them the option to donate it to the Arthritis Foundation; 67% of respondents opted to send the incentive to the Arthritis Foundation

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Appendix A- ACHES Survey Questionnaire (including screening questions)

http://www.cdc.gov/arthritis/data_statistics/pdf/Specifications_for_ACHES.pdf

Appendix B- Published/presented ACHES analyses to date

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