

# Instructions for Analyzing Data from CAHPS® Surveys:

## Using the CAHPS Analysis Program Version 3.6

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For additional guidance, please email [cahps1@ahrq.gov](mailto:cahps1@ahrq.gov) or call the Help Line at (800) 492-9261.

*This document explains how the Analysis Program works and how sponsors and vendors can use the program to interpret the results of their CAHPS survey. While the program was initially designed for the CAHPS Health Plan Survey, you can use it to analyze data from any of the CAHPS surveys. Guidance specific to individual surveys is also provided in each **CAHPS Survey and Reporting Kit**.*

## The CAHPS Analysis Program

The goal of the CAHPS Analysis Program – often referred to as the CAHPS macro – is to provide the user with a flexible way to analyze CAHPS survey data in order to make valid comparisons of performance. Written in SAS, the CAHPS Analysis Program is designed to assist CAHPS survey users in implementing two kinds of statistical adjustments.

**Comparing items and composites.** CAHPS surveys collect consumers' and patients' reports and ratings of a number of dimensions of health care. Comparing performance based on all the individual CAHPS survey items is a very complex task. Moreover, individual survey items are often less reliable than multiple item combinations. To simplify the interpretation of the data and enhance the reliability of the results, questions that measure similar topics are grouped together. These groups of questions, called **composites**, facilitate comparisons of performance across your unit of analysis (e.g., health plan, medical practice, clinician). (Note: Each CAHPS Survey and Reporting Kit includes a document that lists the items in the reporting measures, i.e., composite measures and ratings, for that survey.)

**Adjusting for case mix.** The CAHPS Team recommends that you adjust the survey data for respondent age, education, and general health status. This makes it more likely that reported differences are due to real differences in performance, rather than differences in the characteristics of enrollees or patients.

## Computing Requirements

The CAHPS Analysis Program was developed using SAS® software. SAS is a data management, analysis, and presentation product produced by SAS, which is headquartered in North Carolina. The operation of SAS requires a Base system, but a number of individual modules can be added to perform more complex analyses and data manipulation.

The CAHPS Analysis Program requires Base SAS and the SAS/STAT module. Base SAS, which is required to use any SAS product, provides the data manipulation, print commands, simple plotting capabilities, and procedures for descriptive statistics. Base SAS includes the CORE module. The SAS/STAT module adds several statistical procedures for use by SAS. The CAHPS Analysis Program uses the SAS regression

procedure, PROC REG, to do part of its case-mix calculations. If case-mix calculations will not be used, then the macro requires Base SAS only. .

The CAHPS Analysis Program was written in version 6.12 of PC SAS and version 6.12 of SAS/STAT. The program should work on all SAS platforms that have version 6.0 or later. It has been extensively tested on UNIX and Windows SAS products and has performed well.

## Pre-Analysis Decisions

The CAHPS Analysis Program offers the user a number of options for analyzing the survey data. Before preparing to run the program, analysts should make sure that the project team has agreed upon answers to the following questions. Their implications for the CAHPS Analysis Program are reviewed below. Having these questions answered early will save time when doing the analyses.

### ***What is the reporting unit (e.g., health plan, provider group or clinic, site of care, individual physician)?***

If the project team has collected data at many different levels, the team needs to decide whether to analyze the units together or conduct analyses separately. If the data are to be analyzed together, no changes to the CAHPS Analysis Program are necessary. If the data are to be analyzed separately and the survey vendor has grouped the units into a single data file, it is necessary to code selection criteria (subsetting statements) into the Analysis Program, split the data file into separate files, or use the subset option in the CAHPS macro call.

Note that the CAHPS Analysis Program was initially written for the CAHPS Health Plan Survey. Therefore, variable names, examples, and other references throughout the program refer to health plans. Review the survey-specific guidance provided in each CAHPS Survey and Reporting Kit for specific instructions on adapting the program for other surveys.

### ***Will you analyze specific population groups separately?***

If the project team has collected data for different groups of people, the team needs to decide whether to analyze the data separately or together. Subgroups that you may be considering for separate analyses can be defined by payer (e.g., Medicare, Medicaid, privately insured), geographic region (e.g., state, county, region), or other factors. If the groups are to be analyzed together, no changes to the CAHPS Analysis Program are necessary. If a team decides to analyze the groups separately and the data file contains more than one group, it is important to set up selection criteria in the CAHPS Analysis Program or split the data set.

### ***Will adult and child surveys be analyzed together or separately?***

The Analysis Program allows users to specify how child and adult surveys will be analyzed. The project team needs to decide whether to analyze surveys about adults and children separately or together. If adult and child survey data are to be analyzed together, the team must also decide whether to consider interaction effects. Interaction effects are important to consider in an analysis when the impact of age or health status on one of the reporting items depends on whether an adult or child survey is being analyzed. See the section called *Explanation of Statistical Calculations* for a more detailed discussion of interaction effects. We recommend that you consider interaction effects when combining adult and child data.

If the team collected only adult or child surveys, users still need to specify an option listed below in the CAHPS Analysis Program. There are four options depending on which surveys are in the data set and how the user wants to analyze them:

<b>Option value</b>	<b>Surveys in data set</b>	<b>Analysis method</b>
<b>0</b>	Adult and child surveys, only adult surveys, or only child surveys	Combine adult and child survey data; do not consider interaction effects
<b>1</b>	Adult and child surveys	Combine adult and child survey data; consider interaction effects
<b>2</b>	Adult and child surveys or only child surveys	Child surveys only
<b>3</b>	Adult and child surveys or only adult surveys	Adult surveys only

### ***Will high and low users of health care services be analyzed together or separately?***

The CAHPS Analysis Program allows users to analyze the data for survey respondents with a high or low number of outpatient visits separately or combined. The criterion for establishing low and high users of outpatient services is based on Question 7 of the *CAHPS Health Plan Survey – Adult Commercial Questionnaire*. High users are defined as respondents who indicated that they have had three or more visits for their own care to a doctor’s office or clinic (not including emergency room visits). Low users indicated that they have had fewer than three visits to a doctor’s office or clinic.

The CAHPS Consortium recommends reporting data for global ratings (e.g., respondent’s rating of their personal doctor or nurse, specialists, health care in the last 12 months, and/or health plan) according to outpatient utilization. It is

up to the project team to decide whether to analyze the survey data for low and high users separately or together. You can then choose from the corresponding Option Values listed below for the CAHPS Analysis Program.

Option value	Analysis decision
1	Combine low and high users.
2	Low users only (< 3 visits)
3	High users only (≥ 3 visits)

### ***What level of significance (p-value) will you use in the analysis?***

The CAHPS Consortium recommends a  $p$ -value of 0.05 to test for statistically significant differences between the entities being compared. The  $p$ -value the team chooses must be specified in the CAHPS Analysis Program.

### ***What, if any, level of substantive (practical) significance will you use to compare performance?***

Substantive significance refers to an absolute difference between the entities being compared (e.g., health plans, provider groups, individual physicians) that must be achieved before a change is considered meaningful. If two health plans, for example, had significantly different average scores based on the  $p$ -value criteria, the difference between the plans' average scores may still not be large enough to be meaningful.

The CAHPS Analysis Program has two options that allow the user to specify a difference that is substantive. You can use these options simultaneously or specify only one.

**First method.** The team decides on a percentage of the distance to the nearest bound that is meaningful. The example presented below explains this concept.

Assume the analysis of a global rating question (one that uses a 0-10 rating scale) has the following mean scores for a global rating question across all health plans:

Global Rating Question overall mean (0-10 scale) = 6

To determine a level of difference between plans that is substantively large:

1. Determine the distance from the mean to the nearest bound:
  - a) Compute the distance from the lower bound

$$\text{Mean (6) - Lower bound (0) = 6}$$

- b) Compute the distance from the mean to the upper bound

$$\text{Upper bound (10) - mean (6) = 4}$$

- d) Determine the smaller difference

$$\text{Minimum (6,4) = 4}$$

2. The distance from the nearest bound is 4. Now the project team must decide what percentage of this distance is a meaningful difference between plans. This fraction is entered in the CAHPS Analysis Program.

**Second method.** A much simpler method available in the macro program is to specify an absolute difference that must exist between the plan mean and the mean for all plans in the analysis for a difference to be considered significant. For this method, the user needs only to specify the absolute difference considered to be meaningful.

### *Do you need to adjust the results for case mix?*

Case mix refers to the respondents' health status and other sociodemographic characteristics, such as age or educational level, that may affect the ratings of the health plan, providers, or care. Without an adjustment, differences between entities could be due to case-mix differences rather than true differences in quality. Each project team must determine if it is appropriate to adjust its data to account for case-mix differences.

#### *What to adjust for*

If the project team decides to adjust the data for case-mix, it must choose the appropriate adjusters. The CAHPS Consortium recommends using general health status, age, and education. Individuals in better health and older individuals tend to rate their care, plans, and providers higher. There is also evidence from a number of studies that education affects ratings, with more educated individuals giving lower ratings.

#### *Missing data for case-mix adjusters*

If case-mix adjusted results will be used, the project team must decide whether or not to impute missing data for the adjusters at each adjuster's plan-level mean.

#### *Risk of out-of-range values for case-mixed means*

In the special cases where there are very few records for an analysis variable or all respondents answered in only one or two response categories, there is the possibility that the case-mix adjusted values will be out of range. For

example, if all respondents to a Health Plan Survey answered “Yes,” where 0= “No” and 1= “Yes” to a yes/no question, and the adjustment for that plan is up, the adjusted mean for that plan would be greater than 1 and the adjusted frequencies would be less than zero for the “No” category and greater than 1 for the “Yes” category.

The macro does not force a change in these values, since it would change the mean of the means on the adjusted scores but not on the unadjusted scores. It is recommended that, in reports to a plan, you set these out-of-range values to the minimum or maximum value for that category. Then a manual adjustment could be made to the adjacent category if necessary. For example, in the case of three response categories, where the minimum frequency should be zero and the maximum value is 100, the case-mixed frequency results are as follows:

category 1 =	-2.0,
category 2 =	25.0 and
category 3 =	77.0

The results could be adjusted so that

category 1 =	0.0,
category 2 =	23.0 and
category 3 =	77.0

### ***Do results need to be analyzed using weighting and stratification?***

As discussed above, sampling plans can be designed to select disproportionately potential respondents from certain geographic or demographic groups in the population. Alternatively, situations can arise after sampling is complete that create the need to combine data for certain sampling units. For example, this can occur when two plans merge their operations and the survey sponsor chooses to report their results as a combined score. Whether plans are merging their operations or a disproportionate stratified sampling design was used, the CAHPS Analysis Program can perform the appropriate analyses, provided the user specifies the correct strata to be combined and the number of members in each stratum out of the entire population.

## What Does the CAHPS Analysis Program Analyze?

The CAHPS Analysis Program is designed to analyze multi-item composites and single items from the CAHPS survey data. The output from the program compares the performance of an entity (referred to as a plan, because that was the unit of analysis for the original program) to the overall performance of all entities.

The macro accepts five variable types. For four of these, the macro cleans their response values within the expected minimum and maximum range. For the fifth type, the minimum and maximum response values must be entered as an argument.

The following are the variable types:

Variable type	Min – Max response values
1 – Dichotomous	0 – 1
2 – Global rating	0 – 10
3 – How often or other 4-point response scale	1 – 4
4 – 3-point response scale	1 – 3
5 – Other	min_resp – max_resp

**Global ratings** are based on survey items that ask the respondents to rate different aspects of health care on a scale from 0 to 10. For example, the global ratings items in the *CAHPS Health Plan Survey 4.0 – Adult Commercial Questionnaire* are:

- Health care in the last 12 months (Question 8)
- Personal doctor (Question 15)
- Specialist (Question 19)
- Health plan (Question 27)

Overall Ratings		
Q8	Using any number from 0 to 10, where 0 is the worst health care possible and 10 is the best health care possible, what number would you use to rate all your health care in the last 12 months?	<b>Response Format</b>  0-10
Q15	Using any number from 0 to 10, where 0 is the worst personal doctor possible and 10 is the best personal doctor possible, what number would you use to rate your personal doctor?	
Q19	We want to know your rating of the specialist you saw most often in the last 12 months. Using any number from 0 to 10, where 0 is the worst specialist possible and 10 is the best specialist possible, what number would you use to rate the specialist?	
Q27	Using any number from 0 to 10, where 0 is the worst health plan possible and 10 is the best health plan possible, what number would you use to rate your health plan?	

**Composites** are groupings of two or more questions that measure the same dimensions of health care or health insurance plan services. Composites usually are developed for survey items that have the same response options.

For example, the composites in the Health Plan Survey represent the experiences of respondents (adult enrollees or the parents/guardians of enrolled children) in the following areas:

- Getting needed care (2 questions for adults; 2 questions for children).
- Getting care quickly (2 questions for adults; 2 questions for children).
- How well doctors communicate (4 questions for adults; 5 questions for children).
- Health plan information and customer service (2 questions for adults; 2 questions for children).

The following table illustrates how items in the Health Plan Survey 4.0 are grouped into the first of these composites.

<b>Getting Needed Care</b>		
Q17	In the last 12 months, how often was it easy to get appointments with specialists?	<b>Response Format</b> <ul style="list-style-type: none"> <li>▪ Never</li> <li>▪ Sometimes</li> <li>▪ Usually</li> <li>▪ Always</li> </ul>
Q21	In the last 12 months, how often was it easy to get the care, tests, or treatment you thought you needed through your health plan?	

Each survey's complete list of reporting measures – composites and ratings – are provided in a document available in the **CAHPS Survey and Reporting Kit**.

## SAS Data Set Requirements

Before running the CAHPS Analysis Program, make sure that the structure and properties of the data file meet the specifications listed below. If the data set does not meet these requirements, the SAS program will not work properly. Many of the variable coding and cleaning requirements are demonstrated in the next section on using the CONTROL.SAS Analysis Program.

### Data File Specifications

- Each row or case in the SAS data set represents the data for a unique questionnaire.
- If data from different CAHPS questionnaires are in the same data set and are to be analyzed together, each questionnaire is listed on a separate row. If data from adult and child questionnaires are in the data set, the adult and child questionnaires are also listed on separate rows.
- If data from different CAHPS questionnaires are in the same data set, responses for equivalent questions are listed under the same variable names.

### Sample Size Requirements

**Number of plans (i.e., entities such as health plan or providers).** The data set must have surveys from at least two plans. If there is only one plan in the data being analyzed, statistical comparisons cannot be performed and some parts of the program will not work properly. If the CAHPS macro is run with data for one plan, a couple of warning messages and notes will appear in the log file that would not be produced if two or more plans were represented. All

the reports will still be produced, though some of the results will be of limited value.

**Responses.** At least two responses per plan are required by the Analysis Program. We recommend analysis of at least 100 responses for each plan. The program flags plans with fewer than 100 responses for an individual measure, but the analysis is performed on all plans with at least two records. Including plans with very little data tends to reduce the precision of comparisons between individual plans or providers and the overall means. The user can consider removing plans or providers with fewer than 100 responses from the data file before analysis.

**Note:** When analyzing units of analysis such as medical groups or individual physicians, follow the minimum response guidance in the *Fielding the Survey* document in the Kit for that survey. Since the program was initially designed for the CAHPS Health Plan Survey, you will receive the program flags in your results when there are fewer than 100 responses even if the target number of completed responses is less for your survey.

### ***Variable Coding and Cleaning Requirements***

**Numeric variables.** All analytic variables used by the CAHPS Analysis Program must be numeric. Analytic variables include any questionnaire item used to compute CAHPS reporting items, case-mix adjustment variables, the dichotomous variable used to identify child and adult surveys, and the variable used to identify high and low users of outpatient services. These variables are discussed in more detail below. To ensure that an error does not occur in the SAS program, all variables created from survey questions should be coded numerically. If the user recodes character variables to numeric, there should be a minimum length of 4. A length of 8 is recommended for the recode.

**WARNING:** The variables PLAN, CHILD, VISITS, and SPLIT are variable names needed by the CAHPS macro. If the data set has other variables with these names and they do not conform to the specifications below, the macro may produce errors in the log file and the results may be erroneous.

**Variable PLAN.** The variable PLAN must be included in the data set. This variable represents a numeric code or text descriptor for each health plan in the data set. This is the only variable that does not have to be coded numerically. The SAS program accepts alphanumeric, character, and numeric formats for this variable. The maximum variable length for PLAN is 40 characters.

Even if you are not analyzing health plan data, you must use the variable name PLAN to refer to your unit of analysis. This is because the SAS macros use that variable name. However, the variable can be any unit of analysis. For

example, PLAN can represent the names of the medical groups (Group A, Group B, etc.) or individual physicians (Dr. A, Dr. B, etc.).

**Variable CHILD.** The numeric variable CHILD needs to be in the data set if subsetting the data between adult and child records. This variable is used to distinguish between adult and child surveys in the SAS program. CHILD should be coded 0 for adult surveys and 1 for child surveys. If this variable is missing from the data set, the CAHPS macro sets CHILD = 0 when ADULTKID has the values 0, 1, or 3, and sets CHILD = 1 when ADULTKID = 2.

**Variable VISITS.** The variable VISITS needs to be in the data set if using the VISITS parameter. This variable is used to identify high and low users of health care services (e.g., refer to Question 7 from the *CAHPS Health Plan Survey 4.0 -- Adult Commercial Questionnaire*).

The table that follows shows the response values based on item 7 in the *CAHPS Health Plan Survey 4.0 -- Adult Commercial Questionnaire*. We recommend that you use these values while coding your questionnaires. If the VISITS variable is missing from the data set, the CAHPS macro will work fine as long as the VISITS parameter is not equal to 1.

**7. In the last 12 months, not counting times you went to an emergency room, how many times did you go to a doctor's office or clinic to get care for yourself?**

Response value	Label/description
0	None
1	1 time
2	2 times
3	3 times
4	4 times
5	5 to 9 times
6	10 or more times
All other values	Not analyzed by the SAS program

**Variable SPLIT.** The numeric variable SPLIT needs to be in the data set if you are doing separate case-mix adjustments on two different populations as indicated by the macro parameter SPLITFLG = 1. For most cases, the default value 0 for SPLIT does not need to be modified. An example of splitting the case-mix adjustments separately on two populations is when comparing Fee-for-Service populations with Medicaid Managed Care populations.

**Yes/No Variables.** Variables with “yes/no” response categories to be used in the analysis are coded as shown in the table below. Any variable with dichotomous response options should be coded in this manner. For easier interpretation of the results, the “positive” response should have the highest value.

Response value	Label/description
0	No
1	Yes
<b>All other values</b>	Not analyzed by the SAS program

**Three Response Options.** Any variable with three response options should be coded as shown in the table below. For easier interpretation of the results, the “positive” response should have the highest value.

Response value	Label/description
1	Yes, definitely
2	Yes, somewhat
3	No
<b>All other values</b>	Not analyzed by the SAS program

**Four-Point Frequency scale.** Variables with “never” to “always” response options are coded as shown in the table below. Any variable with four response options should be coded in this manner. For easier interpretation, the “positive” response should have the highest value.

Response value	Label/description
1	Never
2	Sometimes
3	Usually
4	Always
<b>All other values</b>	Not analyzed by the SAS program

Response value	Label/description
1	Definitely no
2	Somewhat no
3	Somewhat yes
4	Definitely yes
<b>All other values</b>	Not analyzed by the SAS program

**Global Ratings.** Global rating items with 0-10 response options are coded as shown in the table below:

Response value	Label/description
0	Worst
1	...
2	...
3	...
4	...
5	...
6	...
7	...
8	...
9	...
10	Best
All other values	Not analyzed by the SAS program

**Coding for Adjuster Variables.** If the project team decides to case-mix adjust the CAHPS survey results, numeric variables must also be properly coded for each adjuster variable. The CAHPS Consortium recommends adjusting the data for age, education, and general health status; however, the program allows for a flexible number of adjuster variables. The user can choose the proper specification for each variable used to adjust the data. Specifications used for age, education, and general health status in the CAHPS program are described below. Users may also specify the variables as dichotomous with reference categories (dummy variables). It is important to remember that the SAS program previously cleaned out-of-range values for these variables. However, the added flexibility of a user-specified number of variables and specification of the variables makes it necessary to code out-of-range values to missing before running data through the macro.

The coding specification for the numeric variable EDUCATION is included in the data set. Education refers to the respondent's highest level of school completed. This variable and its response codes should be coded based on the responses to the education item, for example, Question 35 in the *CAHPS Health Plan Survey -- Adult Commercial Questionnaire*.

**35. What is the highest grade or level of school that you have completed?**

Response value	Label/description
1	8 <sup>th</sup> grade or less
2	Some high school, but did not graduate
3	High school graduate or GED
4	Some college or 2-year degree
5	4-year college graduate
6	More than 4-year college degree
All other values	Code to missing

The coding specification for the numeric variable GENERAL HEALTH RATING (GHR) is included in the data set. The GHR is a rating of the survey respondent's overall health status. This variable and its response codes should be based on the responses to the health status item, for example, Question 28 in the *CAHPS Health Plan Survey -- Adult Commercial Questionnaire*.

**28. In general, how would you rate your overall health now?**

Response value	Label/description
1	Excellent
2	Very good
3	Good
4	Fair
5	Poor
All other values	Code to missing

The numeric variable AGE is included in the data set, representing age groupings based on data from the CAHPS survey.

This variable and its response value codes should be based on Question 33 of the *CAHPS Health Plan Adult Commercial Questionnaire* and Question 32 of the *CAHPS Health Plan Child Commercial Questionnaire*. The response values for these questions need to match the values for AGE as follows:

**33. What is your age? / 32. What is your child's age?**

Response value	Label/description (years)
For child surveys:	
0	< 1
1	1-3
2	4-7
3	8-12
4	13-17
For adult surveys:	
1	18 to 24
2	25 to 34
3	35 to 44
4	45 to 54
5	55 to 64
6	65 to 74
7	75 or older
All other values	Code to missing

**Combining Data.** If you want to combine data for reporting from different sampling strata or merged plans or create subsets within the macro, then a text file must be created for these purposes. If no file is specified, the macro creates one using the PLAN variable in the data set to set the “Original Plan” and “New Plan” equal to the PLAN variable, the “Population Size” equal to 1, and “Subsetting Code” equal to 1. An ASCII data set needs to be created with columns separated by one or more spaces for these four variables:

- **Original Plan** – a unique identifier of the units before they are combined. This variable can be coded as alphanumeric, but it cannot exceed 16 characters. This variable is the first column of the data table.
- **New Plan** – identifier for the units that are to be combined. This variable can be coded as alphanumeric, but it cannot exceed 16 characters. This variable is the second column of the data table. If no stratification is being done, this column may look identical to the column for original plan.
- **Population Size** – a numeric variable that indicates the size of the population for the unit. This variable is used to create the weights for combining the strata. The populations for the combined strata should equal the total population of the “new plan.” This variable is the third column of the data table. If no stratification is being done, this column may be set to 1s.

- **Subsetting Code** – identifier for the subset (i.e., region, state, county...) that the plan belongs in. This variable can be coded as alphanumeric. If no subsetting is to be done, this column may be set to 1s.

The ASCII file for the plan details should not contain any missing data and each column of data should be separated by spaces. If tabs are used, the macro may not read in the data correctly. Also, be sure to not have any extra records at the bottom of the ASCII file. If you want to make a quick sample plan detail file from the CAHPS data set, use the program `make_plandtal_dat.sas` as a starting point and change variable names and paths as needed. If the number of plans is small, it is probably easier to create the file by hand.

An example of the plan detail data set is provided for the test version 3.6 test program (`test.sas`). The data file is called “`plandtal.dat`” and looks like the text below:

```
HMO_A_URBAN HMO_A 5000 Northeast
HMO_B_URBAN HMO_B 8000 Northeast
HMO_C_URBAN HMO_C 15000 Atlantic
HMO_B_RURAL HMO_B 2000 Northeast
HMO_C_RURAL HMO_C 3000 Atlantic
```

The TEST data set provides an example for three health plans (2<sup>nd</sup> column) HMO\_A, HMO\_B, and HMO\_C. The urban/rural strata for HMO\_B and HMO\_C are weighted together and the combined plans compared to HMO\_A, which had members only in urban areas.

- The first column provides a unique identifier for each plan/region combination (original plan).
- The second column, the new plan variable, indicates which units will be combined.
- The third column, or the unit population size, is used to compute the weights for the plans. Units with greater population sizes receive more weight than smaller units in the combined plan.
- The fourth column is the region (subset) of the country in which each plan does business.

### ***Adult and Child Interactions (Macro Parameter ADULTKID)***

When the macro parameter ADULTKID equals 1, the macro creates adult and child interactions for the adjuster variables. The macro creates additional adjuster variables, with the a set naming convention, AC1, AC2, ..., ACn, where n is the total number of adjusters originally submitted in the macro call parameter ADJUSTER. When there is an adult and child interaction, the macro creates the ACx variables by looping through the list of adjusters.

For example:

If &ADJUSTER = GHR AGE EDUCATION, then the following additional interaction adjuster variables are created:

```
AC1 = GHR * CHILD
AC2 = AGE * CHILD
AC3 = EDUCATION * CHILD
```

## Using the CAHPS Analysis Program

The steps described below assume a basic knowledge of how to use the SAS system.

### Step 1: Loading the programs and test data

Version 3.6 of the *CAHPS® SAS Analysis Program* contains three core components:

- a SAS control program,
- a SAS macro, and
- a “Plan Detail” data file.

All program and data sets needed for the *CAHPS® SAS Analysis Program*, Version 3.6, were downloaded with your CAHPS Kit. Below is a description of the purpose of each file. Each file should be copied to a project folder related to the CAHPS data set that is to be analyzed.

### **CONTROL.SAS**

CONTROL.SAS is a SAS program that contains examples of the macro call parameter arguments that need to be specified to produce the recommended reporting measures for the *CAHPS Health Plan Survey 3.0 -- Adult Commercial Questionnaire*. (Updated examples of the macro call are provided in the *Survey-Specific Analysis* Instructions found in each Kit.) The program also demonstrates the variable cleaning and coding steps needed to perform the analyses for plan-level comparisons. Modifications most likely will need to be made to this program to reflect how variables are named, how variables are coded or formatted, whether or not plan stratification is used, and whether or not the data set includes child surveys, among the many possible combinations.

### **CAHPS34b.SAS**

CAHPS34b.SAS is the core SAS macro program that performs the analyses the user specifies in the control program. The macro file should not be modified.

### **PLANDTAL.DAT**

This is a sample data set that is used by the CAHPS macro when running the TEST data set. It contains the unique plan names, combined strata names, strata weight, and subsetting code. If this file is not included in your control programs, the macro will create this data set based on the PLAN variable in the input data set.

### **SMALLTEST.SAS**

This program creates a small data set with ten records that can be used to better understand what the CAHPS macro is doing. More details on how this data progresses through the macro can be found in the *Small Data Set Example* section in this document.

### **FORMAT.SAS**

FORMAT.SAS is the SAS program that creates formats helpful to view the data with English words instead of the data values assigned in the TEST data set. The formats have the essence of the tables described in the section *SAS Data Set Requirements*. The program creates the formats in the library named LIBRARY as defined by the libname LIBRARY statement in CONTROL.SAS and TEST.SAS programs. The file, currently set up to work with the test data programs, can be modified for use with other data. Modifications, such as changing the values of the formats, adding new formats or deleting formats, are the most common.

### **TEST.SAS**

TEST.SAS is a test control program for the CAHPS Analysis Program macros. It was designed for use with the test data sets described below. This program was constructed to provide users with a short program and data set that demonstrated the analysis options and output for Version 3.6 of the *CAHPS SAS Analysis Program*.

The hypothetical example was designed to incorporate a disproportionate sampling design of individuals in rural and urban areas for three health plans. One health plan (HMO\_A) has members only in urban areas, while the other two plans (HMO\_B, HMO\_C) have members in both urban and rural areas. To make comparisons across the three plans, the data for the plans with members sampled from rural and urban regions need to be combined using weights.

Various options are used in the test program to demonstrate the analysis features available to the user. Analyses are performed for all three types of reporting items

(single questions, global ratings, and composites). A variety of analysis features are also used, including a varying number of case-mix adjustment variables, turning off the option that creates output data sets, and the weighting option.

### **TEST.SAS7BDAT, TEST.SSD01, TEST\_windows.SAS7BDAT, TEST.SD2**

TEST\*. \* files are SAS data sets that contain the same variables. TEST.SSD01 and TEST.SAS7BDAT are for use with UNIX SAS programs, and TEST.SD2 and TEST\_windows.SAS7BDAT are designed for use with the Windows version of SAS. The table below describes the variables in the data sets and provides value labels for each variable. (Note that the test data files and sets were created for the CAHPS Health Plan Survey 3.0 and have not yet been updated.)

**Table 1: Description of test data set variables**

<b>Variable</b>	<b>Description</b>	<b>Response options</b>
<b>ID</b>	Respondent identification number	Unique numeric value
<b>PlanID</b>	Plan identification number	1=HMO_A_Urban 2=HMO_B_Urban 3=HMO_C_Urban 4=HMO_B_Rural 5=HMO_C_Rural .=Missing
<b>Q31</b>	Global rating of care	0 (worst) - 10 (best) .=Missing 98=Inapplicable 99=No Answer Given
<b>Q38</b>	Global rating of plan	0 (worst) - 10 (best) .=Missing 98=Inapplicable 99=No Answer Given
<b>Q6</b>	Problem to get doctor or nurse that you were happy with	1=A Big Problem 2=A Small Problem 3=Not a Problem .=Missing 98=Inapplicable 99=No Answer Given
<b>Q10</b>	Problem to get a referral to see a specialist that you needed	1=A Big Problem 2=A Small Problem 3=Not a Problem .=Missing 98=Inapplicable 99=No Answer Given

Variable	Description	Response options
Q22	Problem in getting the care you or doctor believed was necessary	1=A Big Problem 2=A Small Problem 3=Not a Problem .=Missing 98=Inapplicable 99=No Answer Given
Q23	Problem with delays in health care while waiting for approval from plan	1=A Big Problem 2=A Small Problem 3=Not a Problem .=Missing 98=Inapplicable 99=No Answer Given
Q05	Was it easy to find a personal doctor or nurse	1=Yes 2=No .=Missing 98=Inapplicable 99=No Answer Given
Q15	How often got the help or advice you needed	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q17	How often got appointment as soon as you wanted	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q19	How often got needed care as soon as you wanted	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given

Variable	Description	Response options
Q24	How often wait in doctor's office	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q39	General health rating	1=Excellent 2=Very Good 3=Good 4=Fair 5=Poor .=Missing 99=No Answer Given
Q40	Age of respondent	1=18 to 24 2=25 to 34 3=35 to 44 4=45 to 54 5=55 to 64 6=65 to 74 7=75 or older .=Missing 99=No Answer Given
Q41	Gender	1=Male 2=Female .=Missing 99=No Answer Given
Q21	Office and clinic visits in the past 6 months	1=None 2=1 time 3=2 times 4=3 to 4 times 5=5 to 9 times 6=10 or more times .=Missing 99=No Answer Given

## Step 2: Modifying CONTROL.SAS

CONTROL.SAS is a SAS program that invokes and executes the macro file, CAHPS34B.SAS, to perform basic analyses for the CAHPS surveys. This program can be modified to perform the analyses that the team has decided to conduct. Statements from CONTROL.SAS are demonstrated below. The user can alter this program to perform analyses on other data sets. The modifications demonstrated below apply to the test SAS program, TEST.SAS, as well. TEST.SAS demonstrates many of the key concepts for a limited number of variables described earlier. (Note

that the test data files and sets were created for the CAHPS Health Plan Survey 3.0 and have not yet been updated.)

### **Identifying the Data Set, Macros, Program, and Output File Locations**

The program statements below specify the library reference and file names for the macros and data sets. These statements should be modified based on the location of the files. Note: The filename statements creating “logfile” and “outfile” are not necessary unless the user wants to save the log information to a file named CONTROL.LOG and the printed results to a file named CONTROL.TXT. The libname statement creating “out” statement is required to identify the location where the data sets of the summary results the program creates will be placed.

```
%let ProgramName = control ;
%let root = /data/cahpsmmc/analysis_program/version_3.0 ;

libname in "&root./sasdata/" ;
libname out "&root./sasdata/control/" ;
libname library "&root./sascatalog/" ;

filename logfile "&root./output/logs/&ProgramName..log" ;
filename outfile "&root./output/&ProgramName..txt" ;
filename cahps "&root./programs/cahps34b.sas" ;
filename plan_dat "&root./data_other/plandtal.dat" ;
```

### **Output Table Titles**

The following code clears the SAS titles and footnotes from the output data tables. This step ensures that any titles and footnotes previously created in a SAS session are cleared before you execute the control program or macro.

```
title ;
footnote ;
```

### **Print the Output to a File**

The following statements can be removed if the user does not want to save the results to an explicitly stated external file.

```
proc printto print = outfile new
    log = logfile new
;
run ;
```

To return the log and output to the default sources, include the following lines of code at the end of the control file.

```
proc printto ;
run ;
```

## Data Set Specifications

The following statements prepare the test data set according to the specifications outlined under *Computing Requirements*. You may need to make modifications to the following statements depending on the variable names and variable response options in the data set. It is very important that all variables in that section are in a temporary or permanent SAS data set that will be used for the analysis. General health status (Q39) and age (Q40) variables are prepared as case-mix adjusters for illustrative purposes.

1. Set permanent or temporary SAS data set.

```
data adult ( drop = i ) ;
  set in.test ;
```

2. Recodes numeric plan variables to character to simplify interpretation of the result tables.

```
length plan $ 16 ;
if planid = 1 then plan = 'HMO_A_URBAN' ;
else if planid = 2 then plan = 'HMO_B_URBAN' ;
else if planid = 7 then plan = 'HMO_C_URBAN' ;
else if planid = 4 then plan = 'HMO_B_RURAL' ;
else if planid = 5 then plan = 'HMO_C_RURAL' ;
else if planid = 6 then plan = 'HMO_BE_1' ;
```

3. Creates visits variable.

```
visits = q21 ;
```

4. Creates child variable by coding it to 0 for all surveys.

```
child = 0 ;
```

5. Recodes dichotomous variables from 1-2 to 1-0.

```
array yn q05 q13;
do i = 1 to dim ( yn ) ;
  if yn [i] = 0 then yn [i] = . ;
  else if yn [i] = 2 then yn [i] = 0 ;
end ;
```

6. REVERSE codes item in which never is a positive response and always is a negative response.

```
array rev q24 ;
do i = 1 to dim ( rev ) ;
  if rev [i] in (1, 2, 3, 4) then rev [i] = 5 - rev [i] ;
  else rev [i] = . ;
end ;
```

7. Version 1.5 and higher of the CAHPS program does not automatically clean case-mix adjustment variables as previous versions did because it allows for a varying number and specification of the adjusters. If adjusters are used in the analysis they must be cleaned first.

```
age = q40 ;
ghr = q39 ;

if ghr not in (1, 2, 3, 4, 5) then ghr = . ;
if age not in (1, 2, 3, 4, 5, 6, 7) then age = . ;
```

### CAHPS34b.SAS—Specifying Arguments and Options

The following statement includes the macro code CAHPS34b.SAS.

```
%include cahps ;
```

The macro call statements for CAHPS34b.SAS in CONTROL.SAS require that at least six arguments, (VAR, VARTYPE, NAME, ADULTKID, DATASET, and OUTNAME), be specified for it to work properly. These arguments, along with the 20 optional arguments, are listed in the table below with the valid value ranges. The six arguments must be specified for each analytic run of the global ratings and composites. If using adjusters, then the ADJUSTER argument is required. The macro call can be repeated any number of times in the SAS program for the different composites and ratings the user wants to compare. Users can also analyze the same composite or global rating more than once by using different macro arguments.

For each composite, the user needs to specify the items listed below in CONTROL.SAS. Arguments with an asterisk (\*) are optional and are needed only in specific cases.

**Table 2. Arguments for CAHPS 3.6 Macro**

Option or argument	Description	Values
Var	Name of variable(s) in composite, or global rating	Name of variable(s) from SAS data set to include in composite or global rating. For composites, separate the variable names by a single space.
Vartype	Type of variable	1 = Dichotomous Scale (yes/no 0-1) 2 = Global Rating Scale (0-10) 3 = How Often Scale or other four-point response scale (“never” to “always” scale 1-4) 4 = Any type of three-point response scale (1-3) 5 = Other Scale (Must assign a value to min_resp and max_resp arguments)

Option or argument	Description	Values								
* Recode	Recodes the global rating* and the 'How Often' scales down to three categories before performing the case-mix adjustment and the statistical tests—the default value is 0	<p>0 = For the statistical tests, use default response options for the variables in the Var argument. For the “Percent of each response” table and report, split the “Rating” scale into three categories with the following break points, 0-6 7-8 9-10 or 1-2 3 4 for the “How Often” scale. Recode option is not needed in the CAHPS macro call if it = 0.</p> <p>1 = For the statistical tests, recode the Global Rating Scale (0-10, vartype = 2) and the “How Often” scale (1-4, vartype = 3) as:</p> <table data-bbox="987 821 1317 915"> <thead> <tr> <th>Rating</th> <th>How Often</th> </tr> </thead> <tbody> <tr> <td>0 - 6 = 1</td> <td>1 - 2 = 1</td> </tr> <tr> <td>7 - 8 = 2</td> <td>3 = 2</td> </tr> <tr> <td>9 - 10 = 3</td> <td>4 = 3</td> </tr> </tbody> </table> <p>If vartype is not equal to 2 or 3, then no recoding occurs for the statistical tests. For the “Percent of each response” table and report, split the “Rating” scale into three categories with the following break points, 0-6 7-8 9-10 or 1-2 3 4 for the “How Often” scale.</p> <p>2 = For the statistical tests, use default response options for the variables in the Var argument. For the “Percent of each response” table and report, split the “Rating” scale into three categories with the following break points, 0-7 8-9 10 or 1-2 3 4 for the “How Often” scale.</p>	Rating	How Often	0 - 6 = 1	1 - 2 = 1	7 - 8 = 2	3 = 2	9 - 10 = 3	4 = 3
Rating	How Often									
0 - 6 = 1	1 - 2 = 1									
7 - 8 = 2	3 = 2									
9 - 10 = 3	4 = 3									

Option or argument	Description	Values								
* Recode (continued)		<p>3 = For the statistical tests, recode the Global Rating Scale (0-10, vartype = 2) and the “How Often” scale (1-4, vartype = 3) as:</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding-right: 20px;">Rating</td> <td>How Often</td> </tr> <tr> <td>0 - 7 = 1</td> <td>1 - 2 = 1</td> </tr> <tr> <td>8 - 9 = 2</td> <td>3 = 2</td> </tr> <tr> <td>10 = 3</td> <td>4 = 3</td> </tr> </table> <p>If vartype is not equal to 2 or 3, then no recoding occurs for the statistical tests.</p> <p>For the “Percent of each response” table and report split the “Rating” scale into three categories with the following break points, 0-7 8-9 10 or 1-2 3 4 for the “How Often” scale.</p>	Rating	How Often	0 - 7 = 1	1 - 2 = 1	8 - 9 = 2	3 = 2	10 = 3	4 = 3
Rating	How Often									
0 - 7 = 1	1 - 2 = 1									
8 - 9 = 2	3 = 2									
10 = 3	4 = 3									
* Min_resp	Used with vartype = 5 only—the minimum response value	Can be any numeric value. It will be used as the low value for the valid response options.								
* Max_resp	Used with vartype = 5 only—the maximum response value	Can be any numeric value. It will be used as the high value for the valid response options.								
Name	Description of composite or global rating	Note: This argument is limited to 40 characters and can be numeric, text, or a combination of both.								
* Adjuster	Name(s) of adjuster variables	Name(s) of case-mix adjuster variables—separated by a space if using more than 1.								
* Adj_bars	Flag indicating if the frequencies for the response values are to be case-mix adjusted for the triple stacked bar—the default value is 0	<p>0 = Do not case-mix adjust the triple stacked bars.</p> <p>1 = Case-mix the triple stacked bars and store the adjusted frequencies along with the unadjusted frequencies.</p>								

Option or argument	Description	Values
* Bar_stat	Flag indicating if permanent data sets for the case-mixed frequencies should be saved—the default value is 0	0 = Do not case save the statistical results in data sets for the case-mix adjusted triple stacked frequency bars. 1 = Save the case-mix adjusted statistical results in permanent data sets for the triple stacked frequency bars.
* Impute	Imputation of missing data for adjuster variables—the default value is 0	0 = Do not impute mean values by plan for all adjuster variables. 1 = Impute mean values by plan for all adjuster variables.
* Even_wgt	Determines how to weight composite items—the default value is 1	0 = Use item weighting for composites. 1 = Use equal weighting for composites (1 / # of Items). 2 = Apply the respondent level weight, in WGTRESP, to the item weighting for composites.
* Kp_resid	Flag used to make the residual values from the SAS work data set RES_4_ID in the STD_DATA module. The residuals are the response values after case-mix adjustments have been made – the default value is 0	0 = Do NOT save the residual response values. 1 = Save the residual response values in a permanent data set.
Adultkid	Specifies how to analyze child and adult surveys	0 = Combine adult and child surveys in analysis; do not consider interaction effects in case-mix adjustment. This option can also be used if the data set contains only a single type of survey. 1 = Combine adult and child survey data in analysis; consider interaction effects between child and each case-mix adjuster variable. 2 = Analyze child data only. 3 = Analyze adult data only.

Option or argument	Description	Values
* Visits	Specifies whether to analyze high and low users together or separately (based on VISITS variable)—the default value is 1	1 = All visits. 2 = Low users only (< 3 visits per 6 months). 3 = High users only (≥ 3 visits per 6 months).
* Pvalue	Level of significance for comparisons—the default value is 0.05	0.05 recommended, but valid values are between 0 and 1.
* Change	Level of practical significance based on a percentage difference from the minimum absolute theoretical difference from the overall mean (can be used only with ‘ <i>p</i> -value’ criteria)—the default value is 0	Value between 0 and 1 (i.e., 25% is entered as 0.25).
* Meandiff	Level of practical significance based on absolute difference between plan mean and mean of all plans (can be used only with ‘ <i>p</i> -value’ criteria)—the default value is 0	Number ≥ 0.

Option or argument	Description	Values
* Wgtdata	Specifies whether samples are stratified within health plan—the default value is 1	1 = Do not invoke weighting macro 2 = Combine strata, weighting
* Wgtresp	Name of the variable storing the weight values for individual respondents.—the default value is blank	Blank or the name of a variable in the data set
* Wgtmean	Name of the variable storing the weight values for the plan means—the default value is blank	Blank or the name of a variable in the data set
* Wgtplan	Specifies whether to use plan weights for the plan level statistical test or not. The default value is zero.	0 = Do not use the plan weights when computing the overall mean for the comparison of plan means. Equal weighting will be used as in previous versions of the macro. 1 = Use the sum of the weights to the plan level of the variable specified in the parameter wgtmean. This weight is used for weighting the overall and grand means used in the statistical comparisons of the plan means.
* Id_resp	If there is unique variable in the data set that identifies each individual respondent, then this variable name may be entered here—the default value is blank	Blank or the name of a variable in the data set. This variable is included in the residual data set when kp_resid = 1. The variable will be a character and have a maximum of 50 characters.

Option or argument	Description	Values
* Subset	Perform the case-mix adjustments and statistical test based on each subset of plans; the subset code is a column in the plan detail file—the default value is 1	1 = No subsetting done. Global case-mix model and centering. 2 = Global case-mix model with centered means for each subset before performing statistical tests. 3 = Subset case-mix model with centered means for each subset.
* Splitflg	The default value of 0 lets the macro run the data set as usual with every plan centered to the same mean and the case-mix being run once. If the flag is set to 1 then the data set must contain the variable SPLIT and the values of this variable in the data set must be 0 and 1 for each plan subset.	0 = Run macro with one case-mix model 1 = Run macro with two case-mix models  Example: Managed Care plans split=0 and for the other plans, Fee for Service, split=1. If there are any missing values for this variable, then these records are dropped from the analysis; the default value is 0.
Dataset	SAS data set name to be used in the analysis (variables recoded and renamed according to “Computing Requirements”)	Data set name depends on how you called in the file.
* Outregre	A flag that indicates whether or not to include the regression output text created by SAS, in the final text report file—the default value is 0	0 = No regression output appears in the text report file.  1 = SAS printout from the PROC REG is included in the text report file.
Outname	Part of SAS data set name for output tables created for summary results	Maximum length is five characters if using SAS 6, can be longer for SAS 8 or later. If the user does not want SAS data sets created enter ‘ ‘. Remember, the results tables will still be created for the .out file.

Examples of using these arguments with the TEST data set are listed below.

- \* Executes CAHPS macro with global rating scale variable, no adjusters and combining strata.

```
%cahps(var = q38,  
vartype = 2,  
name = Rating Health Plan,  
adjuster = ,  
adultkid = 3,  
visits = 1,  
wgtdata = 2,  
dataset = test,  
outname = rplan ) ;
```

- \* Executes CAHPS macro with “How Often” composite variables and the recode option = yes, item weighting option = yes and 2 adjusters;

```
%cahps(var = q15 q17 q19 q24,  
vartype = 3,  
recode = 1,  
name = Getting Care Quickly,  
adjuster = age ghr,  
impute = 1,  
adultkid = 3,  
wgtdata = 2,  
dataset = test,  
outname = quick ) ;
```

## Interpreting the Results

The CAHPS Analysis Program prints the results of the analyses performed for each composite and global rating. The program produces plan-level estimates of missing data for the analysis items and case-mix adjusters, calculates the percentage of responses in each category, compares performance of plans on the reporting item, and flags plans with fewer than 100 responses. If adjusters are used, then the coefficients and the regression analysis are produced for each adjuster item. Examples of results tables from the test data set for global rating scales are reviewed below.

Please note that the results tables are also output to SAS data sets. These data sets implement the following naming conventions where &OUTNAME is the text assigned by the user to the variable “outname” in the CAHPS macro call.

Percentage Items Missing:	P_&OUTNAME
Percentage of Each Response: (for Global Rating aggregates to 0-6, 7-8, and 9-10, or 0-7, 8-9, 10 for “How Often” Scale aggregates to 1-2, 3, and 4)	N_&OUTNAME
Regression Coefficients:	C_&OUTNAME
R-Squared Values	R2&OUTNAME
Residual Values (only if KP_RESID = 1)	Y_&OUTNAME
Overall Statistics for All Plans:	OA&OUTNAME
Star Ratings for All Plans:	SA&OUTNAME
Plans dropped by macro with only 0 or 1 record	DP&OUTNAME

\* See the FAQs on the CAHPS Web site (<https://www.cahps.ahrq.gov>) to learn more about the cutpoints for this scale.

If the stratified weighting option = 2, then the following data sets will be created for each unstratified plan.

Percentage Items Missing:	PW&OUTNAME
Percentage of Each Response:	NW&OUTNAME
Overall Statistics for All Plans:	OW&OUTNAME
Star Ratings for All Plans:	SW&OUTNAME

If the keep permanent data sets for case-mix adjusted frequencies option = 1 and the stratified weighting option = 1, (no stratified weighting), then the following data sets will be created.

Overall statistics for all plans for first bar/frequency:	F1&OUTNAME
Star rating details for all plans for first bar/frequency:	B1&OUTNAME
Overall statistics for all plans for second bar/frequency:	F2&OUTNAME
Star rating details for all plans for second bar/frequency:	B2&OUTNAME
Overall statistics for all plans for third bar/frequency (not for dichotomous variables):	F3&OUTNAME
Star rating details for all plans for third bar/frequency (not for dichotomous variables):	B3&OUTNAME

If the keep permanent data sets for case-mix adjusted frequencies option = 1 and the stratified weighting option = 2 (do stratified weighting), then the following additional data sets will be created.

Overall statistics for unstratified data for first bar/frequency:	FA&OUTNAME
Star rating details for unstratified data for first bar/frequency:	BA&OUTNAME
Overall statistics for unstratified data for second bar/frequency:	FB&OUTNAME
Star rating details for unstratified data for second bar/frequency:	BB&OUTNAME
Overall statistics for unstratified data for third bar/frequency (not for dichotomous variables):	FC&OUTNAME
Star rating details for unstratified data for third bar/frequency (not for dichotomous variables):	BC&OUTNAME

For a detailed description of the computation and statistical analyses used to develop these results, see the section **Explanation of Statistical Calculations**. At this point, all data elements have been collected to perform the testing on the hypothesis.

### **Warnings and Parameter Info**

The following page of the SAS text output shows each of the parameter settings for the Analysis Program. You can use this to identify items you may want to consider when interpreting the results produced by the program, such as entities with fewer than 100 responses to an item after considering missing adjusters and analysis items. No SAS data set is produced that contains all this information.

Rating Scale (0 - 10): Rate Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS

```
*-----*
  CAHPS SAS Analysis Program Version 3.0
  Report run on 20 August 2002 at 13:07:12
*-----*
```

```
***** WARNING NOTE *****
  PLANS WITH FEWER THAN 100 CASES
```

```
-----
  Plan ID 2 - HMO_B_RURAL - 95 Cases
```

```
  Plan ID 4 - HMO_C_RURAL - 69 Cases
```

```
-----
  The Variable Item      = q38
  The Variable Type      = 2
  The 2 Adjuster Variables = ghr age
```

```
Global Case-mix Model
Global Centering of Means
```

```

  The RECODE parameter = 0
  The MIN_RESP parameter = 0
  The MAX_RESP parameter = 10
  The NAME parameter = Rating Health Plan
  The ADJ_BARS parameter = 1
  The BAR_STAT parameter = 0
  The IMPUTE parameter = 1
  The EVEN_WGT parameter = 1
  The KP_RESID parameter = 0
  The ADULTKID parameter = 3
  The VISITS parameter = 1
  The PVALUE parameter = 0.05
  The CHANGE parameter = 0
  The MEANDIFF parameter = 0
  The WGTDATA parameter = 1
  The WGTRESP parameter =
  The WGTMEAN parameter =
  The ID_RESP parameter =
  The SUBSET parameter = 1
  The SPLITFLG parameter = 0
  The data set used      = adult
  The OUTREGRE parameter = 0
  The output data set suffix = q38
```

**Percent of Items Missing by Health Plan**

Rating Scale (0 - 10): Rating Health Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS  
 PERCENT ITEMS MISSING BY HEALTH PLAN

	Global	General		
Total # of Health Plan Respondents	Rating	Health Plan	Age of Rating	Adult
HMO_A_URBAN	345	30.43%	0.58%	1.16%
HMO_B_RURAL	134	29.10%	0.75%	1.49%
HMO_B_URBAN	530	24.15%	0.94%	1.70%
HMO_C_RURAL	90	23.33%	2.22%	0.00%
HMO_C_URBAN	874	29.18%	0.92%	0.69%

Report run on 20 August 2002 at 13:26:15  
 CAHPS SAS Analysis Program Version 3.0  
 Data Set out.p\_q38

**Definition of column headings**

Column	Description
<b>Health plan</b>	Health plan names based on the variable PLAN recoded from PLANID.
<b>Total number of respondents</b>	Total number of respondents in the data set by health plan. For illustration purposes, a plan with less than 100 respondents has been left in the sample output.
<b>Global rating of plan</b> (Label for the variable item Q38)	Percent of cases or records with each item response missing. At least two items must have a valid response to be included in the computation.  The only answers counted as nonmissing by the SAS program for the global rating scales are the responses with integer values from 0 to 10. All other values are converted to the SAS missing value '.'. Computation of percent missing is based on the total number of patients in each plan.
<b>General health rating</b> (Label for the adjuster Q50 - GHR)	Answers counted as nonmissing by the SAS program are the responses excellent (coded 1), very good (coded 2), good (coded 3), fair (coded 4), and poor (coded 5). Computation of percent missing is based on the total number of patients in each plan.
<b>Age of adult</b> (Label for the adjuster Q51 - AGE)	Answers for adult surveys counted as nonmissing by the SAS program are the responses 18-24 (coded 1), 25-34 (coded 2), 35-44 (coded 3), 45-54 (coded 4), 55-64 (coded 5), 65-74 (coded 6), and 75+ (coded 7). Answers for child surveys counted as nonmissing by the SAS program are the responses <1 (coded 0), 1-3 (coded 1), 4-7 (coded 2), 8-12 (coded 3), and 13-17 (coded 4). Computation of percent missing is based on the total number of patients in each plan.

**Percent of Composite Responses by Category<sup>1</sup>**

Rating Scale (0 - 10): Rate Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS  
 PERCENT RESPONSE TYPE - NO IMPUTATIONS

Health Plan	Total # of Respondents	Number of Respondents Analyzed	% Rating		
			0 - 6	7 - 8	9 - 10
HMO_A_URBAN	345	240	17.08%	37.50%	45.42%
HMO_B_RURAL	134	95	21.05%	38.95%	40.00%
HMO_B_URBAN	530	402	15.92%	34.08%	50.00%
HMO_C_RURAL	90	69	15.94%	33.33%	50.72%
HMO_C_URBAN	874	619	15.19%	38.93%	45.88%
Health Plan	Adjusted Bar 1	Adjusted Bar 2	Adjusted Bar 3		
HMO_A_URBAN	17.66%	37.99%	44.35%		
HMO_B_RURAL	20.81%	39.35%	39.84%		
HMO_B_URBAN	16.02%	33.90%	50.09%		
HMO_C_RURAL	15.38%	32.57%	52.05%		
HMO_C_URBAN	15.33%	38.98%	45.69%		

Report run on 20 August 2002 at 13:26:15  
 CAHPS SAS Analysis Program Version 3.0  
 Data Set out.n\_q38

Definition of column headings	
Column	Description
<b>Health plan</b>	Health plan names based on the variable PLAN recoded from PLANID.
<b>Total number of respondents</b>	Total number of respondents in the data set by health plan.
<b>Number of respondents analyzed</b>	Number of respondents with nonmissing values (as defined in Percent of Missing Items on page 44).
<b>Percent Rating 0 - 6</b>	Percent of Rating item with response values from 0 to 6, by health plan.
<b>Percent Rating 7 - 8</b>	Percent of Rating item with response values equal to 7 or 8, by health plan.
<b>Percent Rating 9 - 10</b>	Percent of Rating item with response values equal to 9 or 10, by health plan.
<b>Adjusted Bar 1</b>	Case-mix adjusted frequencies for bar 1, Percent of Rating item with response values from 0 to 6, by health plan.
<b>Adjusted Bar 2</b>	Case-mix adjusted frequencies for bar 2, Percent of Rating item with response values equal to 7 or 8, by health plan.
<b>Adjusted Bar 3</b>	Case-mix adjusted frequencies for bar 3, Percent of Rating item with response values equal to 9 or 10, by health plan.

<sup>1</sup> For a detailed explanation of how these calculations were performed, see the section called *Explanation of Statistical Calculations*.

**Case-mix Adjuster Regression Coefficients**

Rating Scale (0 - 10): Rate Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS  
 REGRESSION COEFFICIENTS FOR ADJUSTER VARIABLES

Name	Variable split	Subset Name	Q38
ghr	0	GLOBAL	-0.4171
age	0	GLOBAL	0.3131

Report run on 20 August 2002 at 13:26:15  
 CAHPS SAS Analysis Program Version 3.0  
 Data Set out.c\_q38

Definition of column headings		
Column	Description	
<b>Variable name</b>	Q39 = General health rating	Q40 = Age
	1 - Excellent	1 - 18-24
	2 - Very good	2 - 25-34
	3 - Good	3 - 35-44
	4 - Fair	4 - 45-54
	5 - Poor	5 - 55-64
		6 - 65-74
		7 - 75+
<b>Split</b>	If the SPLITFLG parameter equals 0, then there is no split for the case-mix regression and split is 0. If SPLITFLG equals 1, then the two regressions are run, one for each split, where split equals 0 and 1.	
<b>Subset name</b>	If subsetting is used for case-mix adjustment, the subset name or code is found in this column. Otherwise it defaults to GLOBAL; that is, it used all records in the case-mix adjustment regression.	
<b>Q38</b>	Regression coefficients for the Global Rating of Plan variable.	

**R-Squared Values for Dependent Variables**

Rating Scale (0 - 10): Rate Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS  
 R-SQUARED VALUES for DEPENDENT VARIABLES

Split	Name	Subset variable	Dependent R-squared	Adjusted R-squared
0	GLOBAL	Q38	0.0765	0.0752

Report run on 20 August 2002 at 13:26:15  
 CAHPS SAS Analysis Program Version 3.0  
 Data Set out.r2q38

Definition of column headings	
Column	Description
<b>Split</b>	If the SPLITFLG parameter equals 0, then there is no split for the case-mix regression and split is 0. If SPLITFLG equals 1, then the two regressions are run, one for each split, where split equals 0 and 1.
<b>Subset Name</b>	If subsetting is used for case-mix adjustment, the subset name or code is found in this column. Otherwise it defaults to GLOBAL; that is, it used all records in the case-mix adjustment regression.
<b>Dependent Variable</b>	Global Rating of Plan variable.
<b>R-squared</b>	The R-squared value from the regression for the dependent variable.
<b>Adjusted R-squared</b>	The Adjusted R-squared value from the regression for the dependent variable.

## Overall Statistical Test Results

Rating Scale (0 - 10): Rate Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS  
 P-Value For Contrast = 0.05 - Change > 0 - Meandiff > 0  
 Overall Statistics from t-test  
 Ho: Plan Means All Equal

Name	Mean	Subset DFR	Overall DFE	F-Statistic	P-Value
GLOBAL	7.9767	4	1,418	1.4138	0.2270

Report run on 20 August 2002 at 13:26:15  
 CAHPS SAS Analysis Program Version 3.0  
 Data Set out.oaq38

Definition of column headings	
Column	Description
<b>Subset Name</b>	If subsetting is used for case-mix adjustment, the subset name or code is found in this column. Otherwise it defaults to GLOBAL; that is, it used all records in the case-mix adjustment regression.
<b>Overall Mean</b>	The mean of all the plan means.
<b>DFR</b>	The numerator degrees of freedom.
<b>DFE</b>	The denominator degrees of freedom.
<b>F-Statistic</b>	The results of the F-test on the null hypothesis.
<b>P-Value</b>	One minus the probability of the F distribution.

NOTE: "Ho" presents a global test of the null hypothesis that all plans have the same adjusted mean rating.

**G. Statistical Test Performance by Health Plan**

Rating Scale (0 - 10): Rate Plan  
 Analysis = ADULTS ONLY - Visits = COMBINE LOW AND HIGH USERS  
 P-Value For Contrast = 0.05 - Change > 0 - Meandiff > 0

ALL PLANS

Plan Name	Total# of Respondents	# of Respondents Analyzed	Unadjusted Plan Mean	Adjusted Plan Mean
HMO_A_URBAN	345	240	7.9708	7.9284
HMO_B_RURAL	134	95	7.7053	7.7148
HMO_B_URBAN	530	402	8.1493	8.1460
HMO_C_RURAL	90	69	7.9855	8.0311
HMO_C_URBAN	874	619	8.0727	8.0633

  

Plan Name	Plan Diff. From Overall Mean	Std Error of Difference	Variance of the Mean	Rating
HMO_A_URBAN	-0.0483	0.1084	0.0124	**
HMO_B_RURAL	-0.2619	0.1611	0.0360	**
HMO_B_URBAN	0.1693	0.0925	0.0070	**
HMO_C_RURAL	0.0543	0.1829	0.0486	**
HMO_C_URBAN	0.0866	0.0835	0.0044	**

Report run on 20 August 2002 at 13:26:15  
 CAHPS SAS Analysis Program Version 3.0  
 Data Set out.saq38

Definition of column headings	
Column	Description
<b>Plan Name</b>	Health plan names based on the variable PLAN recoded from PLANID.
<b>Total Number of Respondents</b>	Total number of patients in the data set by health plan.
<b>Number of Respondents Analyzed</b>	Number of respondents with nonmissing values (as defined above) for the composite.
<b>Unadjusted Plan Mean</b>	Average health plan composite not adjusted for age or health status.
<b>Adjusted Plan Mean</b>	Average health plan composite adjusted for age and health status.
<b>Plan Diff. from Overall Mean</b>	“Overall Mean” minus “Adjusted Plan Mean.”
<b>Std Error of Difference</b>	Standard error of “Plan Difference From Mean.”
<b>Variance of the Mean</b>	Variance of the plan means.
<b>Rating</b>	Star rating of plan performance for the global plan rating based on a comparison of plan’s “Adjusted Plan Mean” to “Overall Mean” Identifies statistically meaningful differences. * = Health Plan was significantly below average ** = Health plan was not significantly above or below average *** = Health plan was significantly above average

## Small Data Set Example

This section uses a small data set with ten records, two plans, two questions, two adjusters and one weight variable to walk through an example of what happens to the data set as it moves through the CAHPS macro. The periods (.) in the table below represent missing values. The observation numbers are not a part of the data set; they are used only for reference purposes later. The sample tables after this one use the shorter column headings (Obs, Plan, Q1, Q2, A1, A2).

SAS data set SMALLTST						
Obs Observation	Plan	Q1 Question 1	Q2 Question 2	A1 Adj 1	A2 Adj 2	Weight
1	A	2	4	1	1	40
2	A	3	.	2	2	50
3	A	4	2	3	.	6
4	A	4	3	.	.	8
5	A	3	3	2	3	10
6	B	3	3	2	3	3
7	B	.	.	4	5	5
8	B	2	2	5	4	3
9	B	3	2	6	3	5
10	B	7	3	3	3	3

The plan detail file is created by the macro and looks like the data set below. This data set is used by the macro to identify the plans it needs to analyze and create sequential plan numbers for use within the macro. Plan A is assigned the value of 1 and Plan B is assigned the value of 2. The macro needs the numeric values to perform looping functions at various points. In the “ALLCASES” section of the macro, it merges this information with the SMALLTST data set. In this example, we do not perform any strata weighting or subsetting of the data, so the values for these fields are set to 1. For the remainder of this example, the plan names A and B are used and the internal macro identifications are ignored.

Plan details data				
Observation	Original plan	New plan	Population size (strata weight)	Subsetting code
1	A	A	1	1
2	B	B	1	1

This example follows two paths for the analysis of the composite measure Q1 and Q2. One uses no adjuster variables, **Run 1**, and the other uses the two adjusters, A1 and A2, without imputation of missing values of the adjuster's mean within plan, **Run 2**. The macro cleans (making sure the values are within the valid range for the given variable type) the items being analyzed, Q1 and Q2. In the macro call they were indicated as being a type 3 variable, which means the response values must be a 1, 2, 3, or 4. Any other response value is set to missing. In our small data set (observation 10), Q1 has a value of 7 so it is set to missing; all other values are fine. The adjuster values are not cleaned in the macro, so all values are accepted.

**The first step in the macro that begins to prepare the data for the reports is the “USABLE” section of the macro.** This checks for missing values in each observation and determines whether to keep the record based on the macro arguments. The results may differ depending on whether adjusters are used and whether missing adjusters get an imputed mean value. The observations that are dropped for Run 1 and Run 2 after the “USABLE” section are noted as follows:

Obs	Plan	Q1	Q2	A1	A2	Run 1 - No Adj	Run 2 - With Adj
1	A	2	4	1	1		
2	A	3	.	2	2		
3	A	4	2	3	.		A2 Missing
4	A	4	3	.	.		A1 & A2 Missing
5	A	3	3	2	3		
6	B	3	3	2	3		
7	B	.	.	4	5	Q1 & Q2 Missing	Q1 & Q2 Missing
8	B	2	2	5	4		
9	B	3	2	6	3		
10	B	.	3	3	3		

**The next few sections of the macro use the records retained from the “USABLE” section, nine records for Run 1 and seven records for Run 2.** These sections simply report and summarize that data for low number of respondents, percent missing for each variable, and the percent breakdown of the response categories. The next step is to standardize each analysis variable in the data to a mean of zero and perform the case-mix adjustment if there are adjusters, as in Run 2.

**Next we must determine the case-mix adjusters for each plan and the residuals for each item to obtain the adjusted means and calculate the variance for each plan.** In Run 1, we are not doing any case-mix adjustments, so the adjustment to the means is zero and the residuals are the standardized values in the above table. In Run 2, there are adjusters, so the macro performs the regression necessary to get the adjustments for the means and the residuals.

Adjustments (on mean = 0)		
Plan	Run 1	Run 2
A	0.00	-0.25
B	0.00	0.25

Obs	Plan	Residuals			
		Run 1		Run 2	
		Q1	Q2	Q1	Q2
1	A	-1.20	1.00	-0.67	0.50
2	A	-0.20	.	0.33	.
3	A	0.80	-1.00	NA	NA
4	A	0.80	0.00	NA	NA
5	A	-0.20	0.00	0.33	-0.50
6	B	0.33	0.50	0.33	0.50
7	B	NA	NA	NA	NA
8	B	-0.67	-0.50	-0.67	-0.50
9	B	0.33	-0.50	0.33	-0.50
10	B	.	0.50	.	0.50

The next step is to multiply each residual by the item's equal weight, 1/number items in the composite (0.50) and divide by the total number of valid responses within plan and item in the composite. Then we can sum the results of the weighted residuals for each composite record.

Obs	Plan	Run 1	Run 2
1	A	0.005	-0.09
2	A	-0.020	0.06
3	A	-0.045	NA
4	A	0.080	NA
5	A	-0.020	0.03
6	B	0.118	0.04
7	B	NA	NA
8	B	-0.174	-0.12
9	B	-0.007	0.06
10	B	0.063	-0.02

Next we sum the squared composite weighted residuals by plan.

Plan	Run 1	Run 2
A	0.009	0.01
B	0.048	0.02

The final step to prepare for the statistical test is to calculate the variance within the plan using the above results by plan, multiplied by the number of usable records, divided by the number of usable records minus one.

Plan	Run 1	Run 2
A	0.012	0.017
B	0.064	0.027

At this point, all data elements have been collected to perform the testing on the hypothesis.

## Explanation of Statistical Calculations

The purpose of this section is to describe the CAHPS macros in sufficient detail so that a statistically sophisticated reader can understand what analyses have been applied and some of the essential details of the implementation.

### General Description

The CAHPS macros are designed to carry out a series of standard analyses on cleaned CAHPS data sets.

**Inputs to the macro.** The input to the macro is a SAS data set with one observation per survey respondent. The data set may contain only child responses, only adult responses, or a mixture of the two. (If there is a mixture, an option must be selected to indicate which group(s) are included in the analysis.) See *Step 2, Modifying CONTROL.SAS* for more details on the preparation of the files.

**Outputs and statistical tests.** The macro produces the following printed outputs for each summary scale (0-10 single item scale) and composite evaluation item:

1. A summary of warnings and parameter information.
2. A summary of missing data (item nonresponse) rates by item and plan.

3. A summary table of responses by item and plan for each category (with “never” and “sometimes” combined for “How Often” Scale and 0-6, 7-8 and 9-10 combined for the Global Rating Scale).
4. If adjusters are used, a printout of the regression for each adjuster, a table of the adjuster coefficients and the dependent variable R-squared value.
5. Overall results of a summary hypothesis test indicating the strength of the evidence that the plan means are not all identical on the given item or composite.
6. A table summarizing the statistical analysis, which includes unadjusted and adjusted plan means (percent “yes” for “yes/no” items), differences from the overall mean and standard error of those differences, and star-ratings (one to three stars) indicating statistically significant differences.

### **Data Subsetting and Checking**

**Subsetting.** If only adults or only children are being analyzed but the data file combines both groups, the appropriate records are selected. High users can be selected by specifying the appropriate macro argument.

**Response option checking.** Item responses are checked to make sure that they conform to the response options for that variable item. All other responses are converted to missing values. After this recoding operation, the percent of missing items by plan is calculated and printed for each item in the analysis.

**Number of responses.** The number of cases is calculated for each plan. If the number of cases in the analysis for a plan falls below a cutoff value (100 cases), a warning message is printed. This is only a warning and does not affect any further analyses.

### **Weighting Algorithm for Composites**

Once the SAS program groups the questionnaire items, it then computes means for each plan for each composite and global rating. Because the composites include more than one item, a more elaborate computation is required to develop the mean. CAHPS uses item weights to compute the means of the composites for each plan. Two methods are available for computation of the item weights. First, the CAHPS macro now includes an option to use equal item weighting in the composite, `even_wgt = 1`, where the item weight equals one divided by the total number of items. So if equal weighting was chosen and there were four items in the composite, the item weight is  $1/4 = 0.25$  for each item. By default, if `even_wgt` is not specified in the macro argument, then the composite uses even weighting. An advantage of this approach is that the relative weights of the items in the composite are consistent among survey administrations. Furthermore, survey sponsors may regard each item as equally

important even if some are answered more frequently than others. A disadvantage of this option is a possible loss of statistical precision if an item with few responses is combined, equally weighted, with an item with many responses.

A second approach weights items unequally, in proportion to the number of respondents. To use item weighting by number of responses, the argument `even_wgt = 0` must be entered into the macro call. The following brief explanation of the rationale for selecting this method of computing composite means is followed by a description of how the SAS program carries out the computation. Because there are differences among respondent experiences and, consequently, differences in the rates at which respondents use various services (expressed in skip patterns for various items), there are often different numbers of responses for the items that make up a composite. To reflect the differing numbers of responses by item, each item may be assigned a different weight in the composite score (an item weight). Items that receive a greater number of respondent answers count more toward the composite score. Thus, an item such as “how often did you need to see your personal doctor or nurse” generally has greater weight than “how often did you need to see a specialist” because more respondents are likely to need to see their personal doctors than a specialist.

One not very satisfactory way to create item weights for the composites is to develop a different set of weights for each plan being evaluated, proportional to the number of item responses at that plan. This means, however, that plan composite scores depend not only on the means on each item at the plan but also on the number of valid responses on each item available for that plan. Therefore, a plan could actually have a lower composite score just because it had a high number of responses to an item with generally low scores. Because such effects could distort comparisons among plans, we do not recommend this approach and it is not implemented in the macro.

Another option accounts for the different numbers of valid responses for each item within a composite but does so across all plans by standardizing the item weight. We consider this a valid approach to item weighting for the composites and have incorporated it into the Analysis Program. This approach prevents plans from faring worse or better just because they have fewer available valid responses because of skip patterns.

For composites, the results for the several items must be weighted together. For each composite, a set of data-determined item weights is calculated and used for all plans. The number of valid responses obtained for each item determines these weights.

The following is a formal description of the calculation of unequal item weights. Let

$n_{ip}$  = number of valid responses obtained from plan  $p$  on item  $i$ ,

$n_i = \sum_p n_{ip}$  = total number of valid responses obtained on item  $i$ ,

$w_i = n_i / (\sum_i n_i)$  = weight for item  $i$ , and

$F_{ipr}$  = fraction of responses for item  $i$  for plan  $p$  that fall into response category  $r$ .

The sums are over items  $i$  that are part of this composite.

Then the weighted fraction for response category  $r$  in plan  $p$  is

$$\sum_i w_i F_{ipr}$$

### Case-Mix Adjustment

Another important policy decision regarding the analysis of CAHPS data is whether and how to adjust the data for different case-mix patterns. The CAHPS Development Team has studied this issue, and its recommendations for the adjustment procedure are incorporated into the SAS code, although the user may choose what variables to adjust for. The following explains the importance of the adjustment and how it is implemented.

When comparing health plans on the basis of the ratings by individuals covered by those plans, it is important to adjust the data for patient characteristics known to be related to systematic biases in the way people respond to survey questions. This is called case-mix adjustment. It is automatically performed by the CAHPS Analysis Program if adjusters are specified. For example, if you know that people of a particular age group are reluctant to report problems and persons of that group are disproportionately enrolled in certain plans, it may be desirable to account for that when comparing data among plans. However, it is important to recognize that differences in patterns of responses may reflect real differences in quality of care as well as systematic biases. There is no way to separate these two types of differences based purely on statistical analysis of satisfaction data. The most popular methods for adjusting the data to account for differences in patient characteristics related to systematic biases are regression, stratification, and propensity score analysis, with regression being by far the most commonly used method.

Health status and age are two patient characteristics frequently found to be associated with patient reports about the quality of their medical care. People in worse health tend to report lower satisfaction and more problems with care than do people in better health. Older patients tend to report more satisfaction and fewer problems than do younger patients, although this association is usually not as strong as the one between health status and ratings.

Some CAHPS field test results confirm these general findings. For example, RAND and Harvard's field tests revealed that consumer ratings about health care were consistently higher for those in better health. Health status may be related to ratings of care because sicker persons are more likely to give negative ratings in general (response tendency), because some people are likely to give negative ratings about anything, including their health and the medical care they receive (correlated error), or because they get worse care. There is the same ambiguity with the age association.

Case-mix adjustment is intended to minimize the effects of differences between plans in background characteristics. The weighting algorithm for composites contributes one kind of case-mix adjustment, because it causes the items of a composite to be weighted together in the same proportions, regardless of differences in the response rates to the different items at different plans.

Another kind of case-mix adjustment applies to all of the items and potentially affects all reported results. This part of the adjustment uses a regression methodology, also called covariance adjustment. The user of the software chooses the adjuster variables. For illustrative purposes and because this has been a common choice in CAHPS so far, we assume in this discussion that the adjuster variables are age (AGE) and health status (GHR). If both adult and child records are in the same analysis, there are three additional adjuster variables: child indicator (CHILD), age  $\times$  child interaction, and health status  $\times$  child interaction. The inclusion of these three additional variables has the effect of fitting separate regression coefficients for the adjuster variables among children and adults.

If data are missing for an adjuster variable, the program either (at the option of the user) deletes the case or imputes the plan mean for that variable. The latter procedure avoids losing observations because of missing data; it is acceptable in this setting because, typically, both the size of the adjustment and the amount of missing data on adjusters are small.

Let  $y_{ipj}$  represent the response to item  $i$  of respondent  $j$  from plan  $p$  (after recoding, if any, has been performed). The model for adjustment of a single item  $i$  is of the form;

$$y_{ipj} = \beta_i' x_{ipj} + \mu_{ip} + \varepsilon_{ipj}$$

where  $\beta_i$  is a regression coefficient vector,  $x_{ipj}$  is a covariate vector consisting of two or five adjuster covariates (as described above),  $\mu_{ip}$  is an intercept parameter for plan  $p$ , and  $\varepsilon_{ipj}$  is the error term. The estimates are given by the following equation:

$$\begin{pmatrix} \hat{\beta}_i' \\ \hat{\mu}_i' \end{pmatrix} = (\mathbf{X}'\mathbf{X})^{-1} \mathbf{X}' \mathbf{y}_i$$

where  $\mu_i = (\mu_{i1}, \mu_{i2}, \dots, \mu_{ip})'$  is the vector of intercepts,  $\mathbf{y}_i$  is the vector of responses and the covariate matrix is

$$\mathbf{X} = (\mathbf{X}_a \quad u_1 \quad u_2 \quad \dots \quad u_p)$$

where the columns of  $\mathbf{X}_a$  are the vectors of values of each of the adjuster covariates, and  $u_p$  is a vector of indicators for membership in plan  $p$ ,  $p = 1, 2, \dots, P$ , with entries equal to 1 for respondents in plan  $p$  and 0 for others.

Finally, the estimated intercepts are shifted by a constant amount to force their mean to equal the mean of the unadjusted plan means  $\bar{y}_{ip}$  (to make it easier to compare adjusted and unadjusted means), giving adjusted plan means

$$\hat{a}_{ip} = \hat{\mu}_{ip} + (1/P) \sum_p \bar{y}_{ip} - (1/P) \sum_p \hat{\mu}_{ip}$$

For single-item responses, these adjusted means are reported. For composites, the several adjusted plan means are combined using the weighted mean

$$\hat{a}_p = \sum_i w_i \hat{a}_{ip}$$

### Variance Estimation

An approach to variance estimation is used which is applicable to both the single-item reports and the composites. Variances are calculated for the mean for each plan, conditional on the coefficients for the adjuster variables. Conditionally these means are independent (ignoring the recentering constant that is added to make the mean of the adjusted means equal to that of the unadjusted means for presentation purposes). Conditioning on the regression coefficients is a standard procedure in variance estimation in the analysis of surveys (see Cochran, *Sampling Techniques*, 1977, Chapter 7). It is not difficult to allow for the covariance of the adjusted means due to

uncertainty about the regression coefficients in the case of single-item reports, but it is difficult to do this in a general way for the multi-item composites, when the pattern of missing data varies by item. In the interests of consistency, we use the same procedure for both classes of reports.

We first calculate residuals from the regression model for every item response,

$$z_{ipj} = y_{ipj} - \beta_i x_{pj}$$

where  $\beta_i$  is the regression coefficient vector for item  $i$  and  $y_{ipj}$  is the response to item  $i$  from person  $j$  in plan  $p$ . The adjusted mean  $\hat{\mu}_{ip}$  for plan  $p$ , item  $i$ , is the mean (across nonmissing observations) of  $z_{ipj}$ . If we replace  $z_{ipj}$  with 0 for all missing responses and define  $r_{ipj} = 1$  if there is a nonmissing response and 0 otherwise, then we can write this as

$$\mu_{ip} = \left( \sum_j z_{ipj} \right) / \left( \sum_j r_{ipj} \right)$$

and the composite score for the plan is

$$\mu_p = \sum_i w_i \left( \sum_j z_{ipj} \right) / \left( \sum_j r_{ipj} \right)$$

Linearizing this expression by taking derivatives with respect to each of the sums  $\sum_j z_{ipj}$  and  $\sum_j r_{ipj}$ , we obtain the following approximation:

$$\mu_p \approx \sum_j \left( 1/n_{ip} \right) \sum_i w_i \left( z_{ipj} - r_{ipj} m_{ip} \right) \sum_j d_{pj}$$

where  $n_{ip} = \sum_j r_{ipj}$  is the number of responses to item  $i$  from plan  $p$ ,  $d_{pj}$  is defined by the summand, and  $m_{ip}$  is the mean of  $z_{ipj}$  for the item  $i$  in plan  $p$ . We now apply the standard formula for the variance of an estimated sum,

$$\hat{V}_p = \hat{Var}(\hat{\mu}_p) = \left( n_p / (n_p - 1) \right) \sum_j d_{pj}^2$$

where  $n_p$  is the number of respondents from plan  $p$ . This gives an estimate of a variance of the composite score for plan  $p$ . If the composite consists of a single item, or if there is no item nonresponse, these results correspond to the standard variance formula.

Note that we do not apply any finite population corrections in this variance calculation. The finite population correction is appropriate if the object of our inference is the mean rating from the population of members who are in plan  $p$  at the

present time. Our concern, however, is with the mean rating that is obtained if a new set of subscribers joins the plan, because we are attempting to give guidance to subscribers who are considering anew their choice of plans. Conceptually, we regard the present members as a sample from a super-population of potential members of the plan.

### Combination of Strata

Versions 1.5 and higher of the CAHPS software permit stratified analyses. For these analyses, the adjusted means  $\mu_s$  and variances  $V_s$  are first calculated separately for each stratum within each plan. These calculations are identical to those described above except that stratum within plan should be substituted every time there is a reference to plan. Then means are calculated by combining all the stratum means within each plan. Suppose that the stratum weights are  $W_s$ , where  $\sum_{s \in p} W_s = 1$ . (Here the sum is over all strata  $s$  within plan  $p$ .) Typically these stratum weights are defined as the fraction of the plan's total enrollment that falls in each stratum. The plan mean is calculated as  $\hat{\mu}_p^* = \sum_s W_s \hat{\mu}_s$ . The corresponding variance is calculated as  $\hat{V}_p^* = \sum_{s \in p} W_s^2 \hat{V}_s$ . The quantities  $\hat{\mu}_p^*$  and  $\hat{V}_p^*$  are then used in the remaining solutions in place of  $\hat{\mu}_p$  and  $\hat{V}_p$ .

## Hypothesis Tests and Assignment of Final Ratings

**Global  $F$ -test.** The first test calculated is intended to determine whether there is evidence for differences among plan means. If this test does not find significant differences, it is not necessarily appropriate to report results by plan on the corresponding item or composite.

The weighted mean is calculated as

$$\hat{\mu} = \left( \sum_p \hat{\mu}_p / \hat{V}_p \right) / \left( \sum_p 1 / \hat{V}_p \right)$$

Then the  $F$ -statistic is calculated as

$$F = (1/(P-1)) \sum_p (\hat{\mu}_p - \hat{\mu})^2 / \hat{V}_p$$

This statistic has an approximate  $F$  distribution with  $(P-1, q)$  degrees of freedom; we have found in simulations that  $q = n/P$  (the average sample size per plan) makes the  $F$ -test at worst slightly conservative with typical sample sizes and response distributions. In other words, reported  $p$ -values from the test are slightly larger than they should be, so significant differences are less likely to be declared.

***t*-tests for plan differences from mean.** We compare each plan mean to the mean of the plan means using a *t*-test. The corresponding contrast is

$$\Delta_p = \hat{\mu}_p - (1/P) \sum_{p'} \hat{\mu}_{p'} - ((P-1)/P) \hat{\mu}_p - \sum_{p'}^* (1/P) \hat{\mu}_{p'}$$

where  $\Sigma^*$  represents a sum over all plans except plan  $p$ . Note that the last expression is simply  $(P-1)/P$  times the difference of  $\hat{\mu}_p$  from the mean of all plans except plan  $p$ ; therefore the two formulations (mean vs. mean of all, or mean vs. mean of all others) are equivalent. The variance of  $\Delta_p$  is

$$\hat{V}(\Delta_p) = [(P-1)/P]^2 \hat{V}_p + 1/P^2 \sum_{p'} \hat{V}_{p'}$$

and the *t*-statistic is calculated as  $\Delta_p / \hat{V}(\Delta_p)^{1/2}$ , and referred to a *t* distribution with  $(n_p - 1)$  degrees of freedom, which again is usually slightly conservative.

**Assignment of star ratings.** An “average” plan is assigned two stars. One or three stars are assigned on the basis of simultaneously satisfying a criterion of statistical significance and one of substantive significance. The difference of a plan from the mean is deemed to be statistically significant if the two-sided *p*-value of the *t*-test described above is smaller than a predetermined level. The comparison value for determination of substantive significance is a minimum difference determined as  $\Delta_0 = K \min(\hat{\mu} - \mu_{\text{low}}, \mu_{\text{high}} - \hat{\mu})$ , where  $\hat{\mu}$  is the overall mean,  $\mu_{\text{low}}$  and  $\mu_{\text{high}}$  are the lowest and highest possible values of the score and  $K$  is a fixed constant chosen by the user. A star is given or removed (relative to two stars) only if the difference is statistically significant and also  $|\hat{\mu}_p - \hat{\mu}| > \Delta_0$ . (If  $K = 0$  then  $\Delta_0 = 0$  and the second part of the criterion has no effect.)

## Examining Sample Size Issues for CAHPS Surveys

To examine the effect of small sample sizes, the CAHPS Team looked at the data from the demonstration sites for the CAHPS Health Plan Survey 3.0. In each site the range of number of plans was 2 to 27, with a mean of 10 plans. The minimum sample size per reportable measure ranged from 17 to 418 (mean = 155) and the average sample size ranged from 46 to 468 (mean = 238). The percentage of two star plans per reportable measure ranged from 0 to 100 percent with an average of 71 percent.<sup>2</sup>

<sup>2</sup> Dichotomous items were excluded in these calculations because *CAHPS Health Plan Survey 3.0* does not include them.

The observed site data were used to estimate power for different combinations of number of plans and sample size per plan. Table 3 provides effect sizes (difference between the mean of one plan and the mean of all other plans/  $\sqrt{\text{MSE}}$ ) that can be detected with 80 percent power and alpha of 0.05 (two-tailed) for 2, 5 and 15 health plans with health plan sample sizes varying from 40 to 300. Note that the effect size that can be detected with a sample size per plan of 300 for two health plans is similar to the effect that can be detected for a sample size of 200 when there are 5 health plans (effect sizes of 0.23 and 0.22, respectively). Similarly, the effect size detectable is comparable for two plans with  $n = 100$  per plan versus five plans with  $n = 60$  per plan (0.40 and 0.41, respectively).

**Table 3: Effect size detected with 80 percent power (alpha = 0.05) by number of plans and sample size per plan**

Sample size per plan	2 plans	5 plans	15 plans
300	0.23	0.18	0.17
200	0.28	0.22	0.21
100	0.40	0.32	0.29
80	0.45	0.35	0.33
60	0.51	0.41	0.38
40	0.63	0.50	0.46

Table 4 provides information about the effect size detectable for one plan when the sample size of all plans except that one is fixed at 300. These effect sizes are similar to those reported in Table 5-1 with a few exceptions (lower left corner of tables), revealing how small sample size for one plan has a major impact on the power to detect a difference between the plan and the other plans.

**Table 4: Effect size detected with 80 percent power (alpha = 0.05) by number of plans and sample size for one plan (n = 300 for all other plans)**

Sample size for plan	2 plans	5 plans	15 plans
300	0.23	0.18	0.17
200	0.26	0.22	0.21
100	0.33	0.29	0.29
80	0.35	0.33	0.32
60	0.40	0.37	0.37
40	0.47	0.45	0.45

As an illustration of how effect sizes translate into CAHPS scale points, adult data from one of the sites were examined for the rating of specialist care. Sample sizes ranged from 32 to 104 per plan (mean = 67). Seven of the 10 plans received two stars, one plan received a single star, and two plans received three stars. The overall mean on the item was 8.30 and the smallest plan difference from the mean of other plans that was statistically significant was 0.24 (standard error of difference = 0.12) for a plan with 57 completes. The estimated square root of MSE ( $SE_d/\text{SQRT}(1/n_1 + 1/(N-n_1))$ ) is 0.83. Thus, the observed effect size for this difference was 0.28 (a relatively small effect). Assuming a similar MSE, we have 80 percent power ( $\alpha = .05$ ) to detect differences between one plan and the mean of the other plans of 0.33, 0.27 and 0.24 on the 0-10 scale for sites with 2, 5 and 15 plans, respectively, when the sample size of each plan is 100. Note that these differences correspond to 0.19, 0.16 and 0.14 on the CAHPS “meaningful differences” scale (proportion of the distance from the mean to the nearest extreme).

### Implications of this Analysis

The power to detect a difference between one plan and the mean of the other plans depends upon the sample sizes for all plans (although the sample size of the plan in question has an especially important influence) and the number of plans. With the current CAHPS recommendation of a sample of 100 per health plan per reportable item, there is adequate power to detect an effect size of 0.29 (15 plans) to 0.40 (2 plans) if every plan has the minimum sample size. A similar effect size (0.38) can be detected for a sample size of 60 per plan if there are a total of 15 plans. It is important to note, however, that these power calculations pertain only to the determination of the number of stars a plan receives. The CAHPS bar charts provide an opportunity for pair-wise comparisons and the sample size requirements for a given power are therefore larger.

# Appendix

## Summary of Features Included in Each Version of the CAHPS Analysis Program

**Version 1.0** of the CAHPS SAS Analysis Program offered the following features:

- An assessment of significance using practical and statistical ( $p$ -value) criteria;
- An option to analyze data based on outpatient utilization groupings;
- An option to analyze child and adult data together or separately;
- Comparisons of health plan performance; and
- Case-mix adjustments.

**Version 1.5** of the CAHPS SAS Analysis Program added the following enhancements:

- **Weighting and stratification.** The SAS program performs the correct analyses for disproportionate stratified sampling designs. One way such designs might appear is when two plans that were surveyed separately have subsequently merged their operations into a single business entity, and their results will be reported as a single plan. They also may appear when the sponsor decides to collect additional surveys by using larger sample sizes for a certain subset of people (based on geographic area, gender, age groups, etc.) beyond what would appear there by proportionate allocation. To use this feature, the user must specify which strata are combined and the number of members in each stratum out of the entire population (the weights).
- **Plan name flexibility.** Plan identifiers for programming and output purposes are no longer required to be numeric. Text or numeric names are allowed to facilitate programming and interpretation of results.
- **Case-mix adjusters.** The program no longer requires two case-mix adjusters (age and health status) to be used in the analyses. The user can now specify an unlimited number of adjuster variables or choose not to adjust the data.
- **Substantive differences.** A new method of specifying an absolute difference that must be achieved before a difference is meaningful has been added to the program. While the previous method of determining a meaningful difference is still available, the user can now simply choose an absolute difference that must exist between means for a difference to be flagged as significant.

- **Results tables.** Version 1.5 has an additional feature that creates SAS data sets of the results tables the program produces. This allows users to perform additional analyses on the aggregate results or to create summary reports. Linear regression coefficients for the adjuster variables are now output as part of the results tables and reports.
- **Missing data for adjusters.** In the initial version of the Analysis Program, missing data for the case-mix adjustment variables was imputed at each item's health plan mean. Version 1.5 allows the user to specify whether or not the analysis is conducted with imputation for the adjuster variables.

**Version 2.0 and 2.1** of the CAHPS SAS Analysis Program added the following enhancements and changes:

- The SAS code has been converted to **require only Base SAS and the SAS/STAT** module, eliminating the need for SAS/IML. If adjuster variables are excluded, then the REG procedure in the SAS/STAT module is not needed. The code has been modularized into macros to aid in maintaining the macro and understanding what the macro is doing.
- The macro now has two **additional ways in which to subset the data** being run through the Analysis Program without having to create separate calls of the Analysis Program. With SUBSET = 2, the Analysis Program runs the case-mix model on the entire data set but does the plan/unit comparisons at the subset levels specified in the fourth column of the plan detail file created by the user. With SUBSET = 3, the Analysis Program does both the case-mix and the plan/unit comparisons at the subset levels.
- **Data sets are now created for the output** of the case-mix and hypothesis test calculations. This allows for easy export to Excel or other programs for report generation.
- The **composites are no longer restricted to the “How Often” (1-4) question responses.** The variable type is indicated in the macro call and the macro runs a composite calculation if the number of variables is greater than one. This change was made to accommodate the need to create composites from questions with dichotomous and trichotomous variables. The program can now create composites using all variable types used in the survey
- The **weighting of the composite items** now has the option of doing **equal weighting** across items as well as **weighting based on the number of responses** in each item divided by the total number of responses in all items. The default option for the macro is to use the equal weighting.

- An option is available for **recoding the global rating scales** from 0 – 10 to 1 – 3 and the **“How Often” scales** from 1 – 4 to 1 – 3 using the new parameter RECODE. The primary rationale for the recoding into three categories is to make the data entering into the hypothesis tests entirely consistent with the information presented in the “Bar Graph” reports.

A secondary rationale for recoding is that it may improve the statistical properties of the tests. On general statistical principles, it would not be surprising if the analysis of very skewed data were improved by a transformation that reduced the skewness. In the CAHPS survey, it is plausible that the difference between 0 and 2, both indicating strong dissatisfaction, carries with it less information than the difference between 8 and 10, reflecting average and maximum satisfaction, respectively. Therefore, combining categories at the low end of the scale may remove some meaningless variation from the data. Statistical improvement would be reflected in larger values of the *F*-statistic in the recoded data compared to the original data.

The recoding is defined as:

Rating scale		How often scale	
Response value	Recode	Response value	Recode
<b>Option 1:</b>			
<b>0 – 6</b>	1	1 – 2	1
<b>7 – 8</b>	2	3	2
<b>9 – 10</b>	3	4	3
<b>Option 2:</b>			
<b>0 – 7</b>	1		
<b>8 – 9</b>	2		
<b>10</b>	3		

- A new parameter, **KP\_RESID**, has been added to the macro call to allow **the residual values from the regression to be saved** as a permanent SAS data set. By default, these values are only saved temporarily while the macro is running.

**Version 3.0-3.3** of the CAHPS SAS Analysis Program adds the following enhancements and changes:

- The **plan detail file**, plandtal.dat, and the filename statement that assigns **PLAN\_DAT** are now optional. If the plan detail file does not exist, then

the macro uses the PLAN variable in the dataset called by the CAHPS macro. If used, the plan detail file must have a unique record for each plan name or code. Only the first column is required; if the second column is missing, then the macro creates dummy values for the new plan name equivalent to the first column. If the third and fourth columns have missing values, then they are all set to the value of 1. Each column must be separated by spaces.

- The Analysis Program **now removes any plans that are to be analyzed that have only zero or one usable records.** These changes were made in the submacro USABLE. The plans that are dropped by the macro are saved in a permanent SAS data set labeled dp&outname.
- **The CHILD variable is now optional.** If it does not exist, then the macro creates the variable CHILD. If the ADULTKID parameter is set to 2, then the macro assumes all records in the analysis data set are child records and sets CHILD = 1, otherwise CHILD will be set to 0, indicating there are no child records. If there is a mix of child and adult records in the data set, the user must set up a variable named CHILD and set it equal to 1 for child records and some other value, usually 0 for adult records. Version 3.3 of the CAHPS macro corrects a logic error found in version 3.2 of the macro.
- **The EVEN\_WGT parameter now can apply individual level weights to the composite items.** This third option is activated by setting EVEN\_WGT=2 and uses the weight variable, referenced by WGTRESP.
- The **variance of the mean** variable, vp, has been added to the text output of the adjusted mean report.
- A **CAHPS version label** has been added to the permanent data sets to indicate which version of the CAHPS Analysis Program created the data set. The version number has also been added to the text output.
- Users can now **case-mix the triple-stacked bar frequencies,** using the **ADJ\_BARS** parameter, and include both the non-case-mixed frequencies with the case-mixed frequencies in the final frequency output data set, n\_\*. For variables of type 5 (vartype = 5), these cannot have case-mixed bars since the frequencies for the response values are not aggregated into three bars. To make this work for nonstandard variable types, it is best to do some recoding first to make the three desired ranges and then run the new variable through as a vartype = 4.

The following parameters have been added:

- The parameter **ID\_RESP** stores the original respondent ID value, if one exists, in the permanent data sets. If there is a unique variable in the data set that identifies each respondent, then enter the variable name in this parameter. The macro carries it through the individual data sets and attaches it to the residual data set if KP\_RESID = 1 so the data set can be easily linked to the original if needed. If no ID variable is entered, then the ID\_RESP variable in the macro is set to '.z'. The variable will be a character and have a maximum of 50 characters.
- The parameter flag **OUTREGRE** indicates whether or not the regression output should appear in the text output file. If set to 0, the default, then the SAS printed output from the regressions in the case-mix procedure is not printed out into the output file. If set to 1, then the regression output appears.
- The parameter **WGTRESP** accepts the variable name that contains the weights for individual respondents. This weight is used in the case-mix adjustment regression procedure.
- The parameter **WGTMEAN** accepts a variable that contains the weights to be applied to the means of the plans before the case-mix adjustments are applied.
- The parameter **SPLITFLG** allows the data set to be split into two groups for the purpose of centering the means differently and running two case-mix models through the macro. This was done to deal with the Medicare Managed Care and Fee-for-Service analysis. By default, the parameter is 0 and is not used but, if set to 1, then the data set must contain a variable with the name SPLIT and must have the values of 0 and 1. Any record with a missing value is dropped from the analysis.
- The parameter **BAR\_STAT** stores the results of the case-mixed bars in permanent data sets with the same format as the case-mixed survey question results. The new data sets created have the format B#&outname and F#&outname where the B\* files hold the stars and statistics by plan and the F\* files hold the overall means and statistics. The # has the values 1-3 for a normal macro run, where 1 = the first bar frequency, 2 = the second bar frequency, and 3 = the third bar frequency if it is not dichotomous. &outname is the value given in the macro call parameter OUTNAME. If the data are stratified and stratification weights are used by having the macro parameter WGTDATA = 2, up to six additional files are created with # having the values A-C, where A = the first bar frequency of the combined strata, B = the second bar frequency of the combined strata, and C = the third bar frequency of the combined strata.

- Version 3.3 **corrects a logic error**, contained within version 3.2, that occurred when the parameter **SUBSET = 3**, which runs the macro multiple times based on the subsetting variable in the plan detail file referenced by the FILENAME PLANDTAL statement.
- The text output on the **Warnings and Parameter Info page contains more accurate information about the adjusters** when there are child interactions, when **ADULTKID = 1**. The number of adjusters will reflect the original adjuster variables times 2 plus 1, so if there are originally 2 adjusters, the total number of adjusters with child interactions will be 5, ADJ#1, ADJ#2, ADJ#1 \* CHILD, ADJ#2 \* CHILD, and CHILD.
- Added two **flag lines to the log file** that will indicate if the macro **finds the CHILD and PLAN variables** in the original analysis data set. If there is no child variable, the flag will indicate how the macro created a new CHILD variable.

**Version 3.4** (May-June 2003) of the CAHPS SAS Analysis Program adds the following enhancements and changes:

- Added three **additional variables to the sa\* data set and the output text** of the statistical tests. The **unweighted, unadjusted plan mean** was added to help clarify what the unadjusted mean actually is. Only when the wgtmean parameter is used will the unweighted, unadjusted mean be different from the weighted unadjusted mean. The other variable added is the **95% Confidence Limits for the Difference of the Mean**. This is computed as 1.96 \* the standard error of the difference. When wgtplan = 1, then a third column containing the **summed weights for each plan** will also be added to the sa\* data set, the b\* dataset if frequency bars are to be stored (bar\_stat = 1) and the output text.
- Added in the **weighted, unadjusted frequencies** to the frequency table n\_\* data set and the output text, when the frequency bars are also case mix adjusted.
- The **wgtmean** parameter purpose has been **expanded** to allow for the use of the **sum of the weights to the plan level to be used in the comparison of the plan means**. If a variable exists for the wgtmean parameter, then the individual record level weight is used to compute the weighted, unadjusted plan means. In addition, if the new parameter wgtplan = 1, then the sum of the individual weights to the plan level will be used in weighting the plan mean comparisons. The wgtplan parameter can have the value of 0, default, or 1. When 0, the macro will use equal weights when comparing the plan means. When 1, and the wgtmean parameter has a variable listed, then the sum of the weights to the plan level will be used

computing the overall and grand means which are used in the statistical comparisons of the plan means.

- Added checks on the DATASET parameter to make sure it exists or that the value in the DATASET parameter is a valid SAS data set. If there is an error, the macro will stop processing and print an error message to the log file.
- Added error checking on the merging of the plan detail file with the analysis dataset. If there are no records matching, then the macro will print out the frequencies of the unique PLAN values for both the plan detail file and the analysis data set to the output text file and also print out an error to the log file.

**Version 3.5** (September 2005) of the CAHPS SAS Analysis Program added the following enhancements and changes:

- A disclaimer and copyright statement were added.
- If weights are being used for the individual or plan means, records with weights that are less than zero or missing are removed.
- When macro converts the numeric plan in allcases to character, it left justifies and trims trailing blanks.
- The macro checks that there are plans in all subcodes after the usable data set is made. If some subcodes have all missing plans, it recomputes how the subcodes are used in the looping in the star macro.
- The log comment for when child variable is not found in the original data set was changed.
- A bug was identified in the CAHPS 3.4b macro: Two lines that have length planname \$ 20 when it should be \$ 40 causing a merge problem with the N\_\* data sets. \$ 20 was changed to \$ 40.

**Version 3.6** (April 2006) of the CAHPS SAS Analysis Program added the following enhancements and changes:

- This new version corrects an error in some previous versions affecting calculation of the variances for the comparison of a plan mean to the mean of all other plan means, when the plans were weighted. This error only affects analyses with parameter wgtplan=1 using CAHPS macro versions 3.4b (released May 2003) and 3.5 (released September 2005). By default, the macro sets wgtplan=0 so the error does not affect unweighted plan analysis.

The error caused significance tests to be calculated incorrectly when determining whether a plan's mean was significantly above or below the average. This could cause some plans to be declared 1- or 3-star plans when they were respectively below or above average, but not by a statistically significant amount.

- (July 2006) Modified formula for special case of using only one plan unit and a division by zero error may occur. This case used to work in prior versions. Modified code for checking if SE may be missing to set T=0 in that case. Also, VO can now have a zero denominator, in the case where there is only one unit being analyzed, modified code to catch that error.

(3.6b as of June 2007) This modification to Version 3.6 puts the `_wgtmean` variable in the strata data step in order to address a problem with a missing line that was not keeping the `_WGTPPLAN` variable in the data step that created `wstemp`. Because of the missing line, the use of `wgtdata=2` for combining strata generated a SAS error.