



Instructions for Analyzing Data from CAHPS[®] Surveys in SAS[®]:

Using the CAHPS Analysis Program Version 5.0

AHRQ Contract No.: HHSP233201500026I/HHSP23337004T

Managed and prepared by:

Westat, Rockville, MD

Naomi Yount, Ph.D.
Kayo Walsh, M.S. (Harvard Medical School)
Alan Zaslavsky, Ph.D. (Harvard Medical School)

Edited by Lise Rybowski, MBA

AHRQ Publication No. 20-M019
August 2020



Public Domain Notice. This product is in the public domain and may be used and reprinted without permission in the United States for noncommercial purposes, unless materials are clearly noted as copyrighted in the document. No one may reproduce copyrighted materials without the permission of the copyright holders. Users outside the United States must get permission from AHRQ to reprint or translate this product. Anyone wanting to reproduce this product for sale must contact AHRQ for permission.

CAHPS® is a trademark of AHRQ.

Suggested Citation:

Yount, N., Walsh, K., & Zaslavsky, A. Instructions for Analyzing Data from CAHPS® Surveys in SAS®: Using the CAHPS Analysis Program Version 5.0, (Prepared by Westat, Rockville, MD, under Contract No. HHSP233201500026I). Rockville, MD: Agency for Healthcare Research and Quality; August 2020. AHRQ Publication No. 20-M019.

The authors of this report are responsible for its content. Statements in the report should not be construed as endorsement by the Agency for Healthcare Research and Quality or the U.S. Department of Health and Human Services.

No investigators have any affiliations or financial involvement (e.g., employment, consultancies, honoraria, stock options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in this report.

Contents

1. Introduction.....	1
2. What Does the CAHPS Analysis Program Do?	1
3. What Is Included in the CAHPS Analysis Program?.....	2
4. Pre-Analysis Decisions	3
5. Software Requirement and Data File Specifications	5
6. CAHPS Macro Parameters and Call Statements	8
7. SAS Data Sets Generated by the CAHPS Analysis Program	17

Appendices

Appendix A. Using the Test Data in the CAHPS Analysis Program.....	30
Appendix B. Statistical Explanation of Macro Parameters.....	38
Appendix C. Summary of Features Included in Each Version of the CAHPS Analysis Program	49

Tables

Table 5.1	Yes/No Variables	6
Table 5.2	Three Response Variables	6
Table 5.3	Four-Point Frequency Scale Variables.....	7
Table 5.4	Example of Creating Dummy Variables – What is your age?	7
Table 6.1	Required Parameters for the CAHPS Macro 5.0.....	8
Table 6.2	Optional Parameters for CAHPS Macro 5.0	9
Table 6.3	Original Data and Data Used for Analysis.....	15
Table 7.1	SAS Data Sets Output for All CAHPS Macro Calls	17
Table 7.2	Additional SAS Data Sets Output from Case-Mix Adjustment.....	17
Table 7.3	Additional SAS Data Sets Output from Saving Case-Mix Adjusted Frequencies.....	18
Table 7.4	Additional SAS Data Sets Output from Post-Stratification Weighting Option	19
Table 7.5	Additional SAS Data Sets Output from Saving Case-Mix Adjusted Frequencies for Post-Stratification Weighting Option	19
Table 7.6	Contents of DP&OUTNAME: Plans Dropped	20
Table 7.7	Contents of LR&OUTNAME: Lists Plans with 100 or Fewer Records	20
Table 7.8	Contents of N_&OUTNAME: Response Option Percentages.....	21
Table 7.9	Contents of OA&OUTNAME: Results from Test for Significant Differences	22
Table 7.10	Contents of P_&OUTNAME: Percent Missing Data	23
Table 7.11	Contents of SA&OUTNAME: Plan Level Results	23
Table 7.12	Contents of C_&OUTNAME: Case-mix Adjustment Regression Coefficients	25
Table 7.13	Contents of R2&OUTNAME – R-Squared Results for the Case-mix Adjustment Regression.....	25
Table 7.14	List of Macro Results – Y_&OUTNAME	26
Table 7.15	List of Macro Results – NW&OUTNAME (Similar to N_&OUTNAME but provides the post-stratification weighted results).....	26
Table 7.16	Contents of OW&OUTNAME (Similar to OA&OUTNAME but provides post- stratification weighted results)	27
Table 7.17	Contents of SW&OUTNAME (Similar to SA&OUTNAME but provides post- stratification weighted results)	28
Table A.1	Sample Data for Post-Stratification Weighting.....	34
Table A.2	Description of test data set variables based on CAHPS Clinician & Group Adult Survey 3.0	35
Table B.1	List of Macro Weight Options	41
Table B.2	Case Weighting Used for Case-mix Coefficients	42
Table B.3	Examples of a composite measure with three items using a macro parameter K	45
Table B.4	Examples of composite measure with three items using a macro parameter K and means.....	45

1. Introduction

The CAHPS Analysis Program—often referred to as the CAHPS macro—uses SAS® software to provide survey users with a flexible way to analyze CAHPS survey data in order to make valid comparisons of performance. The program can be applied to any of the CAHPS surveys. This document explains how the CAHPS Analysis Program works and how to use the program to analyze and interpret survey results.

2. What Does the CAHPS Analysis Program Do?

The CAHPS Analysis Program is designed to analyze CAHPS survey data by doing the following tasks:

- **Calculating scores.** The program calculates scores for all [survey measures](#), including individual survey items, ratings, and multi-item composite measures. (Learn about composite measures in the box below).
- **Adjusting for case mix.** The program adjusts the survey data for standard individual case-mix variables such as respondent age, education, and general and mental health status. This adjustment makes it more likely that reported differences are due to real differences in performance rather than differences in the characteristics of enrollees or patients.
- **Comparing scores.** The output from the program also compares the performance of any specific entity (e.g., health plan, hospital, provider group) included in the data set to the overall performance of all entities.

For each CAHPS measure, the main output results from this program include:

- unadjusted scores (e.g., top box scores)
- number of responses used in the analyses
- overall mean score
- case-mix adjusted scores (if applicable)
- case-mix adjuster coefficients (if applicable)
- significance rating between case-mix adjusted scores and overall score
- adjusted percentages for display in three-bar frequency charts (top box, middle box, bottom box)

What Are Composite Measures?

Composite measures combine CAHPS survey questions that measure the same dimensions of patients' experiences with health care or health plan services. The use of composite measures simplifies the interpretation of the data, enhances the reliability of the results (because individual survey items are often less reliable than combinations of multiple items), and facilitates comparisons of performance across a unit of analysis (e.g., health plan, medical practice, clinician).

3. What Is Included in the CAHPS Analysis Program?

The CAHPS Analysis Program version 5.0 has three core components: a SAS macro program, SAS test programs (including the formats), and a test SAS data set. You can download a ZIP file with the program files and data sets from the Agency for Healthcare Research and Quality's CAHPS web page about [analyzing CAHPS survey data](#).

The ZIP file contains the following files:

- **MACRO_CAHPS50.SAS** – This is the core SAS macro program that performs the analyses the user specifies in the SAS test program. The macro file should not be modified.
- **_1_TEST_FORMAT_CAHPS50.SAS** – This program creates formats, which are helpful to view the data with descriptive words instead of the numeric data values assigned in data (e.g., “Always” is shown rather than a “4”).
- **_2_TEST_PREPDATA_CAHPS50.SAS** – This program contains sample code to create recoded versions of some variables for the macro run (e.g., by creating dichotomous or reverse-coded variables).
- **_3A_TEST_CAHPS50.SAS** – This short program provides sample code for calling the macro program with different analysis options and outputs specified.
- **_3B_TEST_CAHPS50_STRATIFIED.SAS** – This program contains sample code for calling the macro with the post-stratification weighting option.
- **TEST_CAHPS50_DATA.SAS7BDAT** – This sample SAS data set is used with all the test programs listed above.
- **TEST_CAHPS50_DATA_recoded.SAS7BDAT** – This sample SAS data set is similar to TEST_CAHPS50_DATA.SAS7BDAT, except the recoded variables created by _2_TEST_PREPDATA_CAHPS50.sas have already been created for you. This data set is for users who do not need to use _2_TEST_PREPDATA_CAHPS50.sas.

Appendix A explains how to use the test data. **Appendix B** provides a statistical explanation of some of the macro parameters. **Appendix C** explains all the changes made to the various versions of the CAHPS Analysis Program over the years.

4. 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. A list of all macro parameters is in **Section 6**.

What is the reporting unit (entity)?

Any analysis of CAHPS data is intended to assess, compare, and report on some type of reporting unit. Examples of such units include health plans, hospitals, provider groups, clinics, sites of care, and individual physicians. To avoid confusion, these instructions use the neutral term “entity” to refer to the unit whose data will be aggregated and analyzed.

Because the CAHPS Analysis Program was initially written for the CAHPS Health Plan Survey, the **reporting unit variable name used in the Analysis Program is “Plan.”** This name has no bearing on the suitability of the program for analyzing data on other types of entities.

Depending on your data collection design, you may be able to use the same data for more than one type of entity. For example, you could analyze a data set to compare provider groups and then analyze the same data to assess individual doctors.

Do you need to adjust the results for case mix?

Case mix refers to the distribution of respondents’ health status and sociodemographic characteristics, such as age or educational level, that may affect survey responses. Without an adjustment, differences among entities could be due to case-mix differences rather than true differences in quality. (See **Case-mix Adjustment** in **Appendix B** for more information.)

The Analysis Program offers an ADJUSTER macro parameter to include case-mix adjustment as well as an IMPUTE macro parameter to impute case-mix variables if your case-mix variables have some missing values.

Will you analyze adult and child surveys together?

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 you are analyzing adult and child survey data together, the team must also decide whether to consider interaction effects. Interaction effects may be an issue when the impact of age or health status on one of the reporting items depends on whether you are analyzing an adult or child survey. You can adjust for interaction effects when combining adult and child data by using the ADULTKID macro parameter. (See **Variable CHILD** in **Section 5**.)

What p-value to test statistical significance will you use in the analysis?

A *p*-value of 0.05 is frequently used to test for statistically significant differences between the entities being compared. If you choose a different *p*-value, you can specify it in the Analysis Program using the PVALUE macro parameter.

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 that must be achieved for that difference to be considered meaningful. For example, two health plans may have statistically significant differences in average scores based on the selected p -value, but the substantive difference between the plans' mean scores may not be large enough to be considered meaningful.

The 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 would be a meaningful difference between entities. You can enter this fraction in the Analysis Program using the CHANGE macro parameter.

Second method. A much simpler method is to specify an absolute difference that must exist between the entity's mean score and the mean score for all entities in the analysis for a difference to be considered substantive. For this method, you can specify the absolute difference considered to be meaningful using the MEANDIFF macro parameter.

Do results need to be analyzed using weighting?

In general, weights carry information that helps to make the data more representative of the target population whose experiences are being assessed. Weighting can arise at three points in the computations performed by the Analysis Program:

- (1) Estimation of case-mix regression coefficients
- (2) Calculation of adjusted entity mean scores
- (3) Calculation of an overall mean score and significance tests of differences from the overall mean score.

To set up weights in the Analysis Program, you can use the WGTRESP, WGTMEAN, and WGTPLAN macro parameters. (See **Case Weighting** in **Appendix B**.)

How do you want to weight the items in the composite measure?

A composite measure requires a more elaborate computation to develop the mean score because it includes more than one item. Users can decide to calculate the composite measure score by selecting one of the weight options: 1. Weight the items by the number of respondents, 2. Weight the items by the sum of the respondent weight, or 3. Equal weight (Weight the items equally, calculate as the average of the number of items). For the equal weight option, users can select an option to adjust the item weight if some of the items in the composite measure have a low response rate. (See **Case Weighting** in **Appendix B**.)

5. Software Requirement and Data File Specifications

SAS® Software Requirement

The CAHPS Analysis Program was developed using SAS software. Running the program requires Base SAS software and the SAS/STAT module. Base SAS, which is required to use any SAS product, provides the print commands, simple plotting capabilities, and procedures for descriptive statistics needed to run the Analysis Program. The SAS/STAT module adds several statistical procedures such as the SAS regression procedure, PROC REG or PROC SURVEYREG, to do part of the case-mix calculations.

Data Set Structure

Each row or case in a SAS data set represents data from a unique questionnaire. **Appendix A** offers examples of how to meet many of the variable coding and cleaning requirements before using the Analysis Program.

If data from different CAHPS questionnaires are in the same data set, responses for equivalent questions are listed under the same variable names, with each row representing data for a unique questionnaire.

Sample Size Requirements

Number of entities (e.g., health plans or providers). The data set must have surveys from at least two entities. If there is only one entity in the data being analyzed, statistical comparisons cannot be performed and some parts of the program will not work properly. All the reports will still be produced, but some of the results will be of limited value.

Number of responses per entity. The Analysis Program requires at least two responses per entity. The program flags entities with fewer than 100 responses for an individual measure, but performs the analysis on all entities with at least two records. Including entities with very little data may reduce the precision of comparisons between individual entities or providers and the overall mean scores.

Variable Naming Requirements

The variable names **PLAN**, **CHILD**, **VISITS**, and **SPLIT** have specific meaning for the Analysis Program. If the data set has other variables with these names that do not conform to the specifications below, the macro may produce errors in the log file and the results may be erroneous. Additionally, variables starting with **RES_** are treated as one of the array statements in the program so variables with these names may cause errors.

Variable PLAN. The variable PLAN, which refers to the reporting unit or entity, must be included in your data set. While the variable can be any type of entity, **it must be called PLAN for the Analysis Program to work.**

The Analysis Program accepts alphanumeric, character, and numeric formats for this variable in the data set. Note that this is the only variable that does not have to be coded numerically. The maximum variable length for PLAN is 40 characters.

Variable CHILD. If your data set combines adult and child data and

- You will analyze the data together (macro parameter ADULTKID = 1) or
- You will conduct child-only analyses (ADULTKID = 2),

you will need to create the dichotomous variable CHILD to distinguish between adult (CHILD = 0) and child (CHILD = 1) surveys.

If the CHILD variable is missing from the data set, the Analysis Program creates a CHILD variable and sets it to CHILD = 0 (Adult).

Requirements for Recoding Survey Response Options

All analytic variables used by the Analysis Program must be numeric. The tables below show the different types of variables that may need to be recoded.

Yes/No Variables. Variables with “yes/no” response categories for analysis should be coded as 0 (No) and 1 (Yes) as shown in Table 5.1. All variables with dichotomous response options should be coded in this manner. For easier interpretation of the results, the “positive” response should have the highest value. Data for dichotomous variables will most likely need to be recoded as the precodes found in the survey instrument for the response values typically set the values of the responses to 2 and 1 rather than 0 and 1.

Table 5.1 Yes/No Variables

Typical Response Value on CAHPS Surveys	Recoded Numeric Response value	Label/description
2	0	No
1	1	Yes
Any other value	. (Missing)	Not analyzed by the CAHPS Analysis Program

Three Response Variables. Any variable with three response options should be coded as shown in Table 5.2. For easier interpretation of the results, the “positive” response should have the highest value. Reverse coding may be necessary to ensure that the most positive response – for example, “Yes, definitely” – has the highest value.

Table 5.2 Three Response Variables

Typical Response Value on CAHPS Surveys	Recoded Numeric Response value	Label/description
1	3	Yes, definitely
2	2	Yes, somewhat
3	1	No
All other values	. (Missing)	Not analyzed by the CAHPS Analysis Program

Four-Point Frequency Scale Variables. Variables with “never” to “always” response options are coded as shown in Table 5.3. All variables with four response options should be coded in this manner. For easier interpretation, the “positive” response – for example, “Always” or “Definitely yes” – should have the highest value.

Table 5.3 Four-Point Frequency Scale Variables

Typical Response Value on CAHPS Surveys	Recoded Numeric Response value	Label/description
4	1	Definitely no
3	2	Somewhat no/Probably no
2	3	Somewhat yes/Probably yes
1	4	Definitely yes
All other values	. (Missing)	Not analyzed by the CAHPS Analysis Program

Coding for Case-Mix Adjuster Variables. If the project team decides to adjust the survey results for case mix, numeric variables must also be properly coded for each adjuster variable. If the adjuster variable is used as a continuous variable, the effects associated with the categories are assumed to be proportional to the differences among the coded values. This approach is different than recoding the adjuster variable as dichotomous with reference categories (dummy variable).” (See **Appendix A** for additional sample SAS code.) The dummy variable corresponding to one category, the “reference category” should be omitted; coefficients corresponding to any other category represent the estimated effect of being in that category relative to the reference category. While the choice of reference category has no effect on the case-mix adjustment results, it is common to use the category with the most responses (or close to the most) as the reference category. Dummy variable coding allows the differences between effects associated with different responses to be determined by the data rather than assuming any particular pattern.

Table 5.4 is an example of recoding AGE into a set of dummy variables, one of which should be omitted from the ADJUSTER macro parameter as the reference category. The response categories on the CAHPS surveys may differ from this example, so please refer to the survey for the appropriate response options.

Table 5.4 Example of Creating Dummy Variables – What is your age?

Typical response value on CAHPS Surveys	Recoded Dummy variables and value	Label/description (years)
1	1 = Age_24under, 0 = not in the group	18 to 24
2	1 = Age25_34, 0 = not in the group	25 to 34
3	1 = Age35_44, 0 = not in the group	35 to 44
4	1 = Age45_54, 0 = not in the group	45 to 54
5	1 = Age55_64, 0 = not in the group	55 to 64
6	1 = Age65_74, 0 = not in the group	65 to 74
7	1 = Age75older, 0 = not in the group	75 or older
All other values		Code to missing

6. CAHPS Macro Parameters and Call Statements

The CAHPS Analysis Program requires six key parameters (VAR, VARTYPE, NAME, ADULTKID, DATASET, and OUTNAME). Table 6.1 below lists the required parameters with the valid value ranges; these parameters have no default value and therefore must be specified. Table 6.2 lists 23 optional parameters, also with the valid value ranges. These optional parameters all have default values and do not need to be specified if the default value is acceptable.

If you are using case-mix adjusters, the ADJUSTER parameter is required. The order of the parameters in the macro call statement does not matter. Parameters should be separated by a comma.

Table 6.1 Required Parameters for the CAHPS Macro 5.0

Required Parameter	Description	Values
Var	Name(s) of variable(s) being analyzed (composite measure items, global rating items, or other single items)	Name(s) of variable(s) from SAS data set to include in the analysis (e.g., composite measure items, global rating, or other single items). For composite measure items, separate the variable names by a single space.
Vartype	Type of variable Note: variables in composite measures should have the same type.	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)
Name	Description of composite measure, global rating item, or other items	Note: This parameter is limited to 40 characters and can be numeric, text, or a combination of both.
Adultkid	Specifies how to analyze child and adult surveys. Note: If analyzing data other than adult only, the CHILD variable must be included in the data set.	0 = Combine adult and child survey data in analysis; do not consider interaction effects in case-mix adjustment. This option can 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. For more details, see the box below on Adult and Child Interactions. 2 = Analyze child data only. 3 = Analyze adult data only.
Dataset	SAS data set name to be used in the analysis	Name of the SAS data set used in the input file (i.e., your data set of CAHPS survey responses).
Outname	Part of SAS data set name for output tables created for summary results	Name for the SAS data sets saved with the summary results. To avoid creating SAS data sets, enter ‘ ‘. The results tables will still be created for the .out file.

Macro Parameter ADULTKID: Adult and Child Interactions

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 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 your adjuster variables are for general health status (GHR), age, and education, then the following additional interaction adjuster variables are created:

AC1 = GHR * CHILD

AC2 = AGE * CHILD

AC3 = EDUCATION * CHILD

Example SAS Macro Call with Only the Required Parameters

The example call statement below includes only the required parameters. Explanatory text is provided next to each parameter between the “/*” and “*/”. All text in between these characters is commented out or ignored by SAS. This example shows a single item (q05_re) being analyzed.

```
%cahps (
  var      = q05_re,           /*Name of variable to be analyzed*/
  vartype  = 1,              /*Set the type of variable: 1=
                             dichotomous scale (1/0)*/
  name     = Make appt for an illness, /*Label for the outcome variable*/
  adultkid = 3,              /*Specify how to analyze child and
                             adult surveys: 3= analyze adult data
                             only*/
  dataset  = test,          /*Name of the input data*/
  outname  = illness        /*Name used for the output data set*/
) ;
```

Table 6.2 Optional Parameters for CAHPS Macro 5.0

Parameter	Description	Values
Describing Variables		
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.
Recode	Recodes the global rating and the “How often” or 4-point scales down to three categories before performing the case-mix adjustment and the statistical tests. The default value is 0.	0 = For the statistical tests, use uncollapsed response options for the variables in the Var parameter. For the “Percent of each response” table and report, use the default recode collapsing into 3 categories.

Parameter	Description	Values
	<p>Default recode into 3 categories is as follows:</p> <p>Rating Scale: Vartype = 2</p> <ol style="list-style-type: none"> 1. 0-6 2. 7-8 3. 9-10 <p>4-point Scale: Vartype = 3</p> <ol style="list-style-type: none"> 1. 1-2 2. 3 3. 4 <p>NOTE: If Vartype is not equal to 2 or 3, then no recoding.</p>	<p>This method is the default; the RECODE option is not needed in the macro call if it = 0.</p> <p>1 = For the statistical tests and the “Percent of each response,” use the default recode collapsed into 3 categories.</p> <p>2 = For the statistical tests, use uncollapsed response options for the variables in the Var parameter.</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. The recode for this option differs from the default recode such that the top box is just the highest response for the rating scale.</p> <p>Rating Scale: Vartype = 2</p> <ol style="list-style-type: none"> 1. 0-7 2. 8-9 3. 10 <p>For the 4-point scale, use the default recode collapsed into 3 categories: 1-2 3 4.</p> <p>3 = For the statistical tests and the “Percent of each response” table, use the recoded collapsed categories as shown in Recode option 2 above.</p>
<p>For Case-Mix Adjusting (only “Adjuster” is required for case-mix adjusting; other case-mix parameters have default values if not specified)</p>		
Adjuster	Name(s) of case-mix adjuster variables	Name(s) of case-mix adjuster variables—separated by a space if using more than one case-mix variable.
Adj_bars	Flag indicating if the frequencies for the response values are to be case-mix adjusted for the triple stacked bar (top box, middle box, bottom box). The default value is 0.	<p>0 = Do not case-mix adjust the triple stacked bars (i.e., top box, middle box, bottom box).</p> <p>1 = Case-mix adjust the triple stacked bars (i.e., top box, middle box, bottom box) and store the adjusted frequencies along with the unadjusted frequencies.</p>
Impute	Flag for imputation of missing data for adjuster variables. The default value is 0.	<p>0 = Do not impute mean values by plan for all adjuster variables.</p> <p>1 = Impute mean values by plan for all adjuster variables.</p>

Parameter	Description	Values
<code>Proc_type</code>	Assign the procedure type for the case-mix regression. The default value is 0.	0 = Run the case-mix model under PROC REG. 1 = Run the case-mix model under PROC SURVEYREG. Note: For PROC SURVEYREG, only a cluster option is available, which sets CLUSTER = PLAN in the CAHPS Analysis Program.
Saving Files		
<code>Bar_stat</code>	Flag indicating if permanent data sets for the case-mixed frequencies should be saved. The default value is 0.	0 = Do not save the statistical results in data sets for the case-mix adjusted triple stacked frequency bars (i.e., top box, middle box, bottom box). 1 = Save the case-mix adjusted statistical results in permanent data sets for the triple stacked frequency bars (i.e., top box, middle box, bottom box).
<code>Kp_resid</code>	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.
<code>Id_resp</code>	If there is a 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 can be included in the residual data set when <code>kp_resid</code> = 1. The variable will be a character and have a maximum of 50 characters.
<code>Outregre</code>	Flag indicating whether or not to include the regression output text created by SAS. The default value is 0.	0 = No regression output appears in the text file. 1 = Print out the regression output to the text file.
Assigning Weights		
<code>Wgtplan</code>	Specifies whether or not to use plan weights for the plan/entity-level statistical test. The default value is 0. Note: Set WGTPLAN = 1 when WGTMEAN is applied.	0 = Do not use the plan/entity weights when computing the overall mean for the comparison of plan/entity means. Equal weighting will be used as in previous versions of the macro. 1 = Use the sum of the weights to the plan/entity level of the variable specified in the parameter <code>wgtmean</code> . This weight is used for weighting the overall and grand means used for the F statistic for

Parameter	Description	Values
		statistical comparisons of the plan/entity means.
<code>wgtmean</code>	Name of the variable storing the weight values for the plan means. The default value is blank. Note: Set WGTPLAN = 1 when this parameter is applied.	Blank if no weight is assigned for the plan/entity or Specify the name of a variable used for the plan/entity-level weight.
<code>wgtresp</code>	Name of the variable storing the weight values for individual respondents. The default value is blank.	Blank if no weight is assigned or Specify the name of a variable used for the response weight.
Overall Weights		
<code>Overall_wt</code>	Weight options for calculating the overall mean. The default value is 2.	0 = Number of respondents 1 = Equal weighting of PLANS (each plan is assigned a weight of 1) 2 = Population: sum of respondent weights (based on WGTMEAN)
Coefficient Weights		
<code>wt_type</code>	Weight options for calculating the case-mix regression coefficients. The default value is 0.	0 = Number of respondents 1 = Equal weighting of PLANS 2 = Population: sum of respondent weights (based on WGTRESP)
Composite Measure Weights		
<code>Even_wgt</code>	Determines how to weight items when calculating composite measures. The default value is 1.	0 = Weight by overall number of respondents for each item. 1 = Use equal weighting of items in composite measures (1 / # of items). 2 = Weight by summing the respondent weight (based on WGTRESP)
<code>κ</code>	Assign a target minimum number of responses for equal weighting of items in composite measures (even_wgt = 1). The default value is 1.	Number > 0.
Post-Stratification Weighting		
<code>wgtdata</code>	Specifies whether post-stratification is used in weighting. The default value is 1 (no strata weight).	1 = Do not perform post-stratification weighting. 2 = Combine strata, conduct post-stratification weighting.

Parameter	Description	Values
	Note: A separate file is required to specify the strata variable (See Step 3b. Post-Stratification Weighting Case in Appendix A. Using the Test Data in the CAHPS Analysis Program).	
Analyzing Data Separately		
Subset	<p>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.</p> <p>Note: A separate file is required to specify the subset variable (See Step 3b. Post-Stratification Weighting Case in Appendix A. Using the Test Data in the CAHPS Analysis Program).</p>	<p>1 = No subsetting done. Global case-mix model and centering.</p> <p>2 = Global case-mix model with centered means for each subset before performing statistical tests.</p> <p>3 = Subset case-mix model with centered means for each subset.</p>
Significance Values		
Pvalue	Level of significance for comparisons. The default value is 0.05.	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 .

Example SAS Macro Call with Optional Parameters

The sample call statement below includes some optional parameters. Explanatory text is provided next to each parameter in between the “/*” and “*/”. All text in between these characters is commented out or ignored by SAS.

```
%cahps (
  var          = q05_re q07_re,          /*Name of variables in the composite
                                         measure to be analyzed*/
  vartype      = 1,                    /*Set the type of variables: 1=
                                         dichotomous scale (1/0)*/
  name         = Sample Composite Measure, /*Label for the outcome variable*/
  adultkid     = 3,                    /*Specify how to analyze child and
                                         adult surveys: 3= analyze adult data
                                         only*/
  adjuster     = age1824 age2534 age3544
                age5564 age6574 age75 ghs, /*List of case-mix adjuster variables
                                         to include*/
  adj_bars     = 1,                    /*Flag for the frequencies to be case-
                                         mix adjusted*/
  bar_stat     = 1,                    /*Flag to save case-mix adjusted
                                         frequencies*/
  impute       = 1,                    /*Flag to impute case-mix adjuster
                                         variables that are missing*/
  dataset      = test,                 /*Name of the input data*/
  outname      = CompositeMeasureName  /*Name used for the output data set*/
) ;
```

For more examples of how to set these parameters, please refer to **Appendix A**.

Cases Dropped When Performing Analyses

The Analysis Program drops some cases when performing analyses based on missing data. This section uses a small data set with ten cases, two entities, two questions, and two case-mix adjuster variables to demonstrate which cases will be used for the analyses.

This example follows two paths for the analysis of a composite measure consisting of two items: Q1 and Q2. **Run 1** uses no adjuster variables; **Run 2** uses two adjuster variables, Adjuster 1 and Adjuster 2, without imputation of missing values of the adjuster’s mean within plan. Note that each item is equally weighted for the composite measure in both sample runs.

Run 1: CAHPS Macro Call Statement

```
%cahps (
  var          = Q1 Q2,                /*Name of the two variables in the
                                         composite measure to be analyzed*/
  vartype      = 3,                    /*Set the type of variable: 3= 4-point
                                         scale*/
  name         = Sample Composite Measure, /*Label for the outcome variable*/
  adultkid     = 0,                    /*Specify how to analyze child and
                                         adult surveys: 0= analyze all data -
                                         all data is adult*/
  dataset      = test,                 /*Name of the input data*/
  outname      = SampCompositeName_Run1 /*Name used for the output data set*/
) ;
```

Run 2: CAHPS Macro Call Statement

```
%cahps (
  var          = Q1 Q2,                /*Name of the two variables in the
                                         composite measure to be analyzed*/
  vartype      = 3,                    /*Set the type of variable: 3= 4-point
                                         scale*/
```

```

name      = Sample Composite Measure, /*Label for the outcome variable*/
adultkid = 0, /*Specify how to analyze child and
              adult surveys: 0= analyze all data -
              all data is adult*/

adjuster = A1 A2, /*List of case-mix adjuster variables
                  to include*/

impute   = 1, /*Flag if missing case-mix adjusters
              to be imputed 1 - default, do not
              impute*/

dataset  = test, /*Name of the input data*/
outname  = SampCompositeName_Run2 /*Name used for the output data set*/
) ;

```

The macro cleans the two items, Q1 and Q2, to make sure the values are within the valid range for the given variable type. The macro call indicated they are 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, Q1 has a value of 7 (case 10) that is set to missing; all other values are fine. The adjuster values are not cleaned in the macro, so all values are accepted.

The macro checks for missing values in each case and determines whether to keep the record based on the macro parameter arguments. The results may differ depending on whether adjusters are used and whether missing adjusters get an imputed mean value. The cases that are dropped for Run 1 and Run 2, and the reasons why, are noted as in the last two columns of the table below.

Please note that the variable PLAN refers to your entity of analysis. The periods (.) in Table 6.3 represent missing values. The case numbers are not a part of the data set; they are used only for reference purposes later.

Table 6.3 Original Data and Data Used for Analysis

Case	Plan	Composite Measure Item: Q1	Composite Measure Item: Q2	Adjuster Adj 1	Adjuster Adj 2	Run 1 (No Adj) Case Dropped	Run 2 (With Adj) Case Dropped
1	A	2	4	1	1		
2	A	3	.	2	2		
3	A	4	2	3	.		Dropped: Adj 2 Missing
4	A	4	3	.	.		Dropped: Adj 1 & Adj 2 Missing
5	A	3	3	2	3		
6	B	3	3	2	3		
7	B	.	.	4	5	Dropped: Q1 & Q2 Missing	Dropped: Q1 & Q2 Missing
8	B	2	2	5	4		
9	B	3	2	6	3		
10	B	.(7)	3	3	3		

Note: The cases in Run 2 that were dropped due to missing adjuster information, could be retained if using the parameter “IMPUTE” to impute missing adjuster information (see Table 6.2).

The macro uses the cases retained from the first cleaning step: nine records for Run 1 and seven cases for Run 2. The macro reports and summarizes the number of cases used in each analysis, the percent missing for each variable, and the percent breakdown of the response categories.

Risk of Out-of-Range Values for Case-mixed Scores

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, it is possible for the case-mix adjusted values to 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 increases the mean score for that health plan, the adjusted mean for that health plan would be greater than one. Further, the adjusted frequencies would be less than zero percent for the “No” category and greater than 100 percent 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. When reporting your CAHPS survey results, it is important to set these out-of-range values to the minimum or maximum value for that category. If necessary, you can then make a manual adjustment to the adjacent category. 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 manually adjusted so that

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

7. SAS Data Sets Generated by the CAHPS Analysis Program

The CAHPS Analysis Program creates permanent SAS data sets that contain the results of the analyses performed for each composite measure, single item measure, or global rating. Tables 7.1-7.5 provide a listing of the SAS data sets created by the CAHPS Analysis Program as well as their naming conventions. Tables 7.6-7.17 describe the variables included in the SAS data sets that have been created.

SAS Data Sets Output and Naming Conventions

The SAS 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.

Table 7.1 SAS Data Sets Output for All CAHPS Macro Calls

Description	SAS Data Set Naming Convention
Lists any plans dropped by macro with only 0 or 1 records	DP&OUTNAME
Lists any plans with less than 100 responses	LR&OUTNAME
Unadjusted and adjusted (if adjusters are included) percentages for each response option (Collapsed into three categories for global rating: 0-6, 7-8, and 9-10, or 0-7, 8-9, 10; for 4-Point Scales: 1-2, 3, and 4)	N_&OUTNAME
Overall statistics for all entities combined	OA&OUTNAME
Percentage missing on the VAR parameter (and Adjusters if included)	P_&OUTNAME
Score details for all entities including significant differences	SA&OUTNAME

Table 7.2 shows the data sets that are created by adding in case-mix adjusters.

Table 7.2 Additional SAS Data Sets Output from Case-Mix Adjustment

Description	SAS Data Set Naming Convention
Regression coefficients for each adjuster variable	C_&OUTNAME
R-squared values	R2&OUTNAME
Residual values (only if parameter KP_RESID = 1)	Y_&OUTNAME

Table 7.3 shows the data files created if the user keeps permanent data sets for case-mix adjusted frequencies using the options:

- ADJ_BARS= 1
- BAR_STAT = 1 and
- the stratified weighting option is not used (WGTDATA = 1).

If VARTYPE = 5, there will be additional SAS Data Sets created for each response option.

Table 7.3 Additional SAS Data Sets Output from Saving Case-Mix Adjusted Frequencies

Description	SAS Data Set Naming Convention
Score details for all entities for <ul style="list-style-type: none"> • Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes 	B1&OUTNAME
Score details for all entities for <ul style="list-style-type: none"> • Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No 	B2&OUTNAME
Score details for all entities <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; and for 3-Point scales: 3 • This data set will not appear when the VAR is dichotomous. 	B3&OUTNAME
Overall statistics <ul style="list-style-type: none"> • Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes 	F1&OUTNAME
Overall statistics <ul style="list-style-type: none"> • Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No 	F2&OUTNAME
Overall statistics for <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; and for 3-Point scales: 3 • This data set will not appear when the VAR is dichotomous. 	F3&OUTNAME

Table 7.4 shows the additional data sets that are created by adding in the post-stratification weighting option (WGTDATA = 2). These data sets provide similar information to the data sets produced when not selecting the option, except they provide the post-stratified weighted results. Specifically, when using the WGTDATA=2 option, the core SAS data sets (e.g., N_&OUTNAME, OA&OUTNAME, P&OUTNAME) provide the results for each strata, while the data sets listed in Table 7.4 are based on the results weighted by the strata (i.e., the post-stratified weighted results).

Table 7.4 Additional SAS Data Sets Output from Post-Stratification Weighting Option

Description	SAS Data Set Naming Convention
Unadjusted and adjusted (if adjusters are included) post-stratified weighted percentages of each response (similar to N_&OUTNAME)	NW&OUTNAME
Overall statistics for all entities combined (similar to OA&OUTNAME but with post-stratified weighted results)	OW&OUTNAME
Percentage missing on the VAR parameter (similar to P_&OUTNAME)	PW&OUTNAME
Score details for all entities including significant differences (similar to SA&OUTNAME but with post-stratified weighted results)	SW&OUTNAME

Table 7.5 provides the data files created if the following parameter statements are included to keep permanent data sets for case-mix adjusted frequencies:

- ADJ_BARS= 1,
- BAR_STAT = 1, and
- Including post-stratification weighting option (WGTDATA = 2).

These data sets provide similar information to the data sets produced when not selecting the post-stratification weighting option, except they provide the post-stratified weighted results. Specifically, when using WGTDATA=2 option, the core SAS data sets (e.g., B1, B2 and B3&OUTNAME, F1, F2 and F3&OUTNAME) provide the results for each strata, while the data sets listed in Table 7.5 are based on the results weighted by the strata or the post-stratified weighted results. If VARTYPE = 5, there will be additional SAS Data Sets created for each response option.

Table 7.5 Additional SAS Data Sets Output from Saving Case-Mix Adjusted Frequencies for Post-Stratification Weighting Option

Description	SAS Data Set Naming Convention
Post-stratification weighted score details for all entities <ul style="list-style-type: none"> • Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes 	BA&OUTNAME
Post-stratification weighted score details for all entities <ul style="list-style-type: none"> • Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No 	BB&OUTNAME
Post-stratification weighted score details for all entities <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; for 3-Point scales: 3 • This data set will not appear when the VAR is dichotomous. 	BC&OUTNAME

Description	SAS Data Set Naming Convention
Post-stratification weighted overall statistics <ul style="list-style-type: none"> • Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes 	FA&OUTNAME
Post-stratification weighted overall statistics <ul style="list-style-type: none"> • Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No 	FB&OUTNAME
Post-stratification weighted overall statistics <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; for 3-Point scales: 3 • This data set will not appear when the VAR is dichotomous. 	FC&OUTNAME

Contents of CAHPS Analysis Program SAS Data Sets

The following tables (7.6 – 7.11) list the contents of the CAHPS Analysis Program SAS data sets created for all macro runs. These data sets implement the following naming conventions where &OUTNAME is the text assigned by the user to the parameter “OUTNAME” in the CAHPS macro call.

Table 7.6 Contents of DP&OUTNAME: Plans Dropped

Variable name	Description
ALLN	Total number of respondents in the data set by PLAN
ORIGPLAN	PLAN dropped from analysis as there were fewer than 2 records
USEN	Number of usable records for PLAN

Table 7.7 Contents of LR&OUTNAME: Lists Plans with 100 or Fewer Records

Variable name	Description
ALLN	Total number of respondents in the data set by PLAN
NEWPLAN	PLAN name (If stratification case, this is the unstratified entity. Otherwise, this variable contains the same entity as ORIGPLAN)
NPLAN_ID	New Plan ID (If stratification case, this is the unstratified entity. Otherwise, this variable contains the same entity as OPLAN_ID)
OPLAN_ID	Original Plan ID (If stratification case, this will be different from NPLAN_ID)
ORIGPLAN	PLAN name (If stratification case, this will be different from NEWPLAN)
PLAN	Entity ID (This is the same as OPLAN_ID. If stratified weight option is not selected, NPLAN_ID is also the same as entity ID. If subsetting is not used, SPLAN_ID is the same as entity ID)
PLANTXT	Entity ID and Entity name
SPLAN_ID	Plan ID (If subsetting is used, the ID number will be created by each subset. If no subsetting is used, this will be the same as OPLAN_ID)

Variable name	Description
STRATWGT	Strata Weight (If no stratification is used, this will be 1)
SUB_ID	Subset ID (If no subset is used, this will be 1)
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to 1.
USEN	Number of usable records for PLAN
USENTXT	Number of usable records for PLAN (stored as a character variable)

Table 7.8 Contents of N_&OUTNAME: Response Option Percentages

Variable name	Description
ALLN	Total number of respondents in the data set by PLAN
OPLAN_ID	Original PLAN ID
PLANNAME	Entity name
PTRES1	Percent response for <ul style="list-style-type: none"> Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 Top box for Yes/No scales: Yes
PTRES2	Percent response for <ul style="list-style-type: none"> Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 Bottom box for Yes/No scales: No
PTRES3	Percent response for <ul style="list-style-type: none"> Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; for 3-Point scales: 3 <p>This variable will not appear when the VAR is dichotomous. If VARTYPE = 5, there will be additional response percentages for each response option.</p>
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to 1.
USEN	Number of usable records for PLAN
Additional Variables Included When ADJ_BARS = 1	
ADJ_1	Case-mix adjusted percentages for <ul style="list-style-type: none"> Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 Top box for Yes/No scales: Yes
ADJ_2	Case-mix adjusted percentages for <ul style="list-style-type: none"> Middle box for Global Rating 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 Bottom box for Yes/No scales: No

Variable name	Description
ADJ_3	Case-mix adjusted percentages for <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; and for 3-Point scales: 3 This variable will not appear when the VAR is dichotomous. If VARTYPE = 5, there will be additional case-mix adjusted percentages for each response option.
If WGTMEAN is not assigned, then WGT_1-WGT3 will be the same as PTRES1- PTRES3	
WGT_1	Unadjusted and weighted percentages for <ul style="list-style-type: none"> • Bottom box for Global Rating: 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes
WGT_2	Unadjusted and weighted percentages for <ul style="list-style-type: none"> • Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No
WGT_3	Unadjusted and weighted percentages for <ul style="list-style-type: none"> • Top box for Global Rating 9-10 or 10; for 4-Point scales: 4; and for 3-Point scales: 3 This variable will not appear when the VAR is dichotomous. If VARTYPE = 5, there will be additional unadjusted and weighted percentages for each response option.

Table 7.9 Contents of OA&OUTNAME: Results from Test for Significant Differences

Variable name	Description
DFE	The denominator degrees of freedom
DFR	The numerator degrees of freedom
GM	Grand mean used for F statistics
NTOT	Number of respondents analyzed
OV_MEAN	The mean of all the PLAN means
OVERALLF	The results of the F-test on the null hypothesis for no difference between entity means
OVERALLP	P-value of the F distribution. If the P-value is less than 0.05 (or other preferred value), the PLAN means are significantly different.
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to GLOBAL.

Table 7.10 Contents of P_&OUTNAME: Percent Missing Data

Variable name	Description
ALLN	Total number of respondents in the data set by PLAN
PLAN	Entity ID
PLANNAME	Entity name
&VAR	The percent of responses on the VAR variable(s) that are missing by PLAN
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to 1.
Additional variables included when ADJUSTER(S) are included	
A separate variable for each adjuster is included in the results. This example shows 4 adjuster variables.	
ADJUSTER1	The percent of responses on the Adjuster 1 variable that are missing by PLAN
ADJUSTER2	The percent of responses on the Adjuster 2 variable that are missing by PLAN
ADJUSTER3	The percent of responses on the Adjuster 3 variable that are missing by PLAN
ADJUSTER4	The percent of responses on the Adjuster 4 variable that are missing by PLAN

Table 7.11 Contents of SA&OUTNAME: Plan Level Results

Variable name	Description
ADJ_MEAN	Weighted (if assigned) and adjusted plan mean for case-mix adjuster variables. If no adjuster or weighting is selected, this will match UNA_MEAN.
ALLN	Total number of respondents in the data set by PLAN
CL95	Half-width of the 95% confidence interval, calculated as 1.96*SE. The true (population) value of the estimate (DELTA) falls within the interval (Estimate -CL95, Estimate +CL95) with 95% confidence.
DELTA	The difference between the PLAN mean and overall mean
MEANING	Rating of plan performance for the VAR variable based on a comparison of the “Plan Mean” to “Overall Mean.” Identifies statistically meaningful differences: 1 = Plan was significantly below average 2 = Plan was not significantly above or below average 3 = Plan was significantly above average
PLAN_WGT	Value of the PLAN weight. If weight not assigned, then this column has PLAN_WGT = 1.
PLANNAME	Entity name
SE	Standard error of “Plan Difference From Mean” or Delta
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to 1.

Variable name	Description
UNA_MEAN	Weighted (if assigned) and unadjusted plan mean (even if case-mix adjuster variables are included)
USEN	Number of usable records for PLAN
UWT_MEAN	Unweighted and unadjusted plan mean (even if weighting is assigned and case-mix adjuster variables are included)
VP	Variance of the plan means

Six additional files are created when case-mix adjustment is performed AND

- the ADJ_BARS= 1 and BAR_STAT = 1 options are chosen, and
- no post-stratification weighting is performed (WGTDATA = 1 (no post-stratification weighting)).

The first three data sets have the same variables described in SA&OUTNAME, which provides the PLAN level overall results (see **Table 7.11**) but these additional files provide results for each response option (collapsed).

- **B1&OUTNAME** provides the statistics for the:
 - Bottom box for the Global Rating (Response options 0-6 or 0-7), 4-Point scales (Response options 1-2), or 3-Point scales (Response option 1).
 - Top box for the dichotomous Yes/No scales (Yes response option).
- **B2&OUTNAME** provides the statistics for the:
 - Middle box for the Global Rating (Response options 7-8 or 8-9), 4-Point scales (Response options 3), or 3-Point scales (Response option 2).
 - Bottom box for the dichotomous Yes/No scales (No response option).
- **B3&OUTNAME** provides the statistics for the:
 - Top box for the Global Rating (Response options 9-10 or 10), 4-Point scales (Response options 4), or 3-Point scales (Response option 4).

For dichotomous variables, this data set is not created.

The second three data sets have the same variables described in OA&OUTNAME, which provides overall results for all PLANS combined (see **Table 7.9**), but these additional files provide results for each response option (collapsed).

- **F1&OUTNAME** provides the results from the tests for significant differences between entities for the:
 - Bottom box for the Global Rating (Response options 0-6 or 0-7), 4-Point scales (Response options 1-2), or 3-Point scales (Response option 1).
 - Top box for dichotomous Yes/No scales (Yes response option).

- **F2&OUTNAME** provides the results from the tests for significant differences between entities for the:
 - Middle box for the Global Rating (Response options 7-8 or 8-9), 4-Point scales (Response options 3), or 3-Point scales (Response option 2).
 - Bottom box for dichotomous Yes/No scales (No response option).
- **F3&OUTNAME** provides the results from the tests for significant differences between entities for the:
 - Top box for the Global Rating (Response options 9-10 or 10), 4-Point scales (Response options 4), or 3-Point scales (Response option 4).

For dichotomous variables, this data set is not created.

Tables 7.12 – 7.14 lists the contents of the additional SAS data sets produced when using case-mix adjusters.

Table 7.12 Contents of C_&OUTNAME: Case-mix Adjustment Regression Coefficients

Variable name	Description
COE_&OUTNAME	Case-mix adjustment regression coefficients
P_&OUTNAME	P-value of case-mix adjustment regression coefficient
SE_&OUTNAME	Standard error of case-mix adjustment regression coefficient
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to GLOBAL.
VARIABLE	Name of case-mix adjuster variable(s)

Table 7.13 Contents of R2&OUTNAME – R-Squared Results for the Case-mix Adjustment Regression

Variable name	Description
ADJRSQ	The adjusted R-squared value from the regression for the dependent variable (OUTNAME variable)
DEPVAR	Name of the OUTNAME variable
RSQ	The R-squared value from the regression for the dependent variable (OUTNAME variable)
SPLIT	This variable is used when data is split into two groups. If the data is not split, it defaults to 0.
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to GLOBAL.

Table 7.14 lists the contents of the additional SAS data set produced when using case-mix adjuster variables and when KP_RESID = 1.

Table 7.14 List of Macro Results – Y_&OUTNAME

Variable name	Description
_ID	Individual assigned ID
_ID_RESP	Original Respondent ID
ITEMNO_MAX	Number of items (for single measures this will equal 1; for composite measures this will equal the number of items in the composite measure)
PLAN	Entity ID
YRESID	Residual

Tables 7.15 – 7.17 provide the contents of the data sets produced when using the post-stratification weighting option.

Table 7.15 List of Macro Results – NW&OUTNAME (Similar to N_&OUTNAME but provides the post-stratification weighted results)

Variable name	Description
ALLN	Total number of respondents in the data set by PLAN
OPLAN_ID	Original PLAN ID
PLANNAME	Entity name
PTRES1	Post-stratification weighted percentage for <ul style="list-style-type: none"> • Bottom box for Global Rating 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes
PTRES2	Post-stratification weighted percentage for <ul style="list-style-type: none"> • Middle box for Global Rating:7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No
PTRES3	Post-stratification weighted percentage for <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; for 3-Point scales: 3 <p>This variable will not appear when the VAR is dichotomous. If VARTYPE = 5, there will be additional post-stratification weighted percentages for each response option.</p>
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to 1.
USEN	Number of usable records for PLAN

Variable name	Description
Additional Variables Included When ADJ_BARS = 1	
ADJ_1	Post-stratification weighted case-mix adjusted percentages for <ul style="list-style-type: none"> • Bottom box for Global Rating 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes
ADJ_2	Post-stratification weighted case-mix adjusted percentages for <ul style="list-style-type: none"> • Middle box for Global Rating: 7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No
ADJ_3	Post-stratification weighted case-mix adjusted percentages for <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; for 3-Point scales: 3 <p>This variable will not appear when the VAR is dichotomous. If VARTYPE = 5, there will be additional post-stratification weighted case-mix adjusted percentages for each response option.</p>
If WGTMEAN are not assigned, then WGT_1-WGT3 will be the same as PTRES1- PTRES3	
WGT_1	Unadjusted, weighted, and post-stratification weighted percentages for <ul style="list-style-type: none"> • Bottom box for: Global Rating 0-6 or 0-7; for 4-Point scales: 1-2; for 3-Point scales: 1 • Top box for Yes/No scales: Yes
WGT_2	Unadjusted, weighted, and post-stratification weighted percentages for <ul style="list-style-type: none"> • Middle box for Global Rating:7-8 or 8-9; for 4-Point scales: 3; for 3-Point scales: 2 • Bottom box for Yes/No scales: No
WGT_3	Unadjusted, weighted, and post-stratification weighted percentages for <ul style="list-style-type: none"> • Top box for Global Rating: 9-10 or 10; for 4-Point scales: 4; for 3-Point scales: 3 <p>This variable will not appear when the VAR is dichotomous. If VARTYPE = 5, there will be additional unadjusted, weighted, and post-stratification weighted percentages for each response option.</p>

Table 7.16 Contents of OW&OUTNAME (Similar to OA&OUTNAME but provides post-stratification weighted results)

Variable name	Description
DFE	The denominator degrees of freedom
DFR	The numerator degrees of freedom
GM	Grand mean used for F statistics
NTOT	# of respondents analyzed
OV_MEAN	The mean of all the PLAN means

Variable name	Description
OVERALLF	The results of the F-test on the null hypothesis for no difference between entity means
OVERALLP	P-value of the F distribution. If the P-value is less than 0.05 (or other preferred value), the PLAN means are significantly different.
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to GLOBAL.

Table 7.17 Contents of SW&OUTNAME (Similar to SA&OUTNAME but provides post-stratification weighted results)

Variable name	Description
ADJ_MEAN	Post-stratification weighted, weighted (if assigned by WGTRESP) and adjusted plan mean for case-mix adjuster variables. If no adjuster or weighting is selected, this will match UNA_MEAN.
ALLN	Total number of respondents in the data set by PLAN
CL95	Half-width of the 95% confidence interval, calculated as $1.96 * SE$. The true (population) value of the estimate (DELTA) falls within the interval (Estimate -CL95, Estimate +CL95) with 95% confidence.
DELTA	The difference between plan mean and overall mean
MEANING	Rating of plan performance for the VAR variable based on a comparison of plan's adjusted and post-stratification weighted "Plan Mean" to "Overall Mean." Identifies statistically meaningful differences. <ul style="list-style-type: none"> 1 = Plan was significantly below average 2 = Plan was not significantly above or below average 3 = Plan was significantly above average
PLAN_WGT	Value of plan weight. If weight not assigned, then this column has PLAN_WGT = 1.
PLANNAME	Entity name
SE	Standard error of "Plan Difference From Mean" or Delta
SUBCODE	If subsetting is used, the subset name or code is found in this column. Otherwise it defaults to 1.
UNA_MEAN	Weighted (if assigned by WGTRESP) and unadjusted plan mean (even if case mix adjuster variables are included)
USEN	Number of usable records for PLAN
UWT_MEAN	Unweighted, unadjusted, and post-stratification weighted plan mean (even if weighting is assigned and case mix adjuster variables are included)
VP	Variance of the plan means

Six additional files are created when case-mix adjustment is performed and

- the ADJ_BARS= 1 and BAR_STAT = 1 options are chosen and
- post-stratification weighting is performed (WGTDATA = 2 (post-stratification weighting)).

The first three data sets have the same variables described in SW&OUTNAME, which provides the PLAN level overall results (see **Table 7.17**), as well as in B1, B2 and B2&OUTNAME. These additional files provide results for each response option (collapsed).

- **BA&OUTNAME** provides the post-stratification weighted statistics for the:
 - Bottom box for the Global Rating (Response options 0-6 or 0-7), 4-Point scales (Response options 1-2), or 3-Point scales (Response option 1).
 - Top box for dichotomous Yes/No scales (Yes response option).
- **BB&OUTNAME** provides the post-stratification weighted statistics for the:
 - Middle box for the Global Rating (Response options 7-8 or 8-9), 4-Point scales (Response options 3), or 3-Point scales (Response option 2).
 - Bottom box for dichotomous Yes/No scales (No response option).
- **BC&OUTNAME** provides the post-stratification weighted statistics for the:
 - Top box for the Global Rating (Response options 9-10 or 10), 4-Point scales (Response options 4), or 3-Point scales (Response option 4).

For dichotomous variables, this data set is not created.

The second three data sets have the same variables described in OW&OUTNAME, which provides overall results for all PLANS combined (see **Table 7.16**) as well as the F1-F3&OUTNAME data set. These additional files provide results for each response option (collapsed).

- **FA&OUTNAME** provides the post-stratification weighted results from the tests for significant differences between entities for the:
 - Bottom box for the Global Rating (Response options 0-6 or 0-7), 4-Point scales (Response options 1-2) or 3-Point scales (Response option 1).
 - For dichotomous Yes/No scales it provides the top box or Yes response option.
- **FB&OUTNAME** provides the post-stratification weighted results from the tests for significant differences between entities for the:
 - Middle box for the Global Rating (Response options 7-8 or 8-9), 4-Point scales (Response options 3), or 3-Point scales (Response option 2).
 - Bottom box for dichotomous Yes/No scales (No response option).
- **FC&OUTNAME** provides the post-stratification weighted results from the tests for significant differences between entities for the:
 - Top box for the Global Rating (Response options 9-10 or 10), 4-Point scales (Response options 4), or 3-Point scales (Response option 4).

For dichotomous variables, this data set is not created.

Appendix A. Using the Test Data in the CAHPS Analysis Program

This appendix explains how to use the test programs and data set provided in the ZIP file for the CAHPS Analysis Program version 5.0:

- **MACRO_CAHPS50.SAS** - This is the core SAS macro program that performs the analyses the user specifies in the SAS test program. *The macro file should not be modified.*
- **_1_TEST_FORMAT_CAHPS50.SAS** - This program creates formats, which are helpful to view the data with descriptive words instead of the numeric data values assigned in data (e.g., “Always” is shown rather than a “4”).
- **_2_TEST_PREPDATA_CAHPS50.SAS** - This program contains sample code to create recoded versions of some variables for the macro run (e.g., by creating dichotomous or reversed-coded variables).
- **_3A_TEST_CAHPS50.SAS** - This short program provides sample code for calling the macro program with different analysis options and outputs specified.
- **_3B_TEST_CAHPS50_STRATIFIED.SAS** - This program contains sample code for calling the macro with the post-stratification weighting option.
- **TEST_CAHPS50_DATA.SAS7BDAT** - This sample SAS data set is used with all the test programs listed above.
- **TEST_CAHPS50_DATA_recoded.SAS7BDAT** - This sample SAS data set is similar to TEST_CAHPS50_DATA.SAS7BDAT except the recoded variables created by _2_TEST_PREPDATA_CAHPS50.sas. have already been created for you. This SAS data set is for users who do not need to use _2_TEST_PREPDATA_CAHPS50.sas.

Before you begin, you need to assign two different library paths for input and output data. The sample code is listed below. Additionally, the formats are stored in the input data set directory.

```
%let ProgramName = Test_cahps50 ;
%let root = /data/cahps/analysis_program/version5.0 ;

libname in      "&root./data/" ;
libname out     "&root./Test_cahps50/" ;
libname library "&root./data/" ;
```

Once you have determined the location of the input and output data, you can begin to use each test program following the steps below.

Step 1. Creating the Format Catalog (1_TEST_FORMAT_CAHPS50)

To use the test data, you should first run `_1_TEST_FORMAT_CAHPS50.sas` to create the formats. Within the program, you will need to assign a library name for storing the format file as shown below. Note that the directory for the formats should have the same path as the data set used for the macro run.

```
%let root = /data/cahps/analysis_program/version5.0 ;

libname in      "&root./data/your format path here" ;
```

Below is an excerpt from the Test Format Catalog.

```
proc format library = in ; /*place the library name where you want to
store the format*/

title "CAHPS Survey Formats for TEST Data Set Version &version " ;

value ynb /*Provides the labeled response categories for each response option
for all variables assigned the format ynb*/
    . = ' .: Missing          '
    1 = ' 1: Yes              '
    2 = ' 2: No               '
    98 = '98: Inapplicable    '
    99 = '99: No Answer Given '
;

value edu /*Provides the labeled response categories for each response option
for all variables assigned the format edu*/
    1=' 1: <= 8TH GRADE'
    2=' 2: SOME HS'
    3=' 3: HS GRAD/GED'
    4=' 4: SOME COLLEGE/2-YR DEGREE'
    5=' 5: 4-YR COLLEGE GRAD'
    6=' 6: >4-YR COLLEGE DEGREE'
    98="98: DON'T KNOW"
    99='99: REFUSED' ;

run;
```

Step 2. Preparing the Data for the Macro (`_2_TEST_PREPDATA_CAHPS50`)

The `_2_TEST_PREPDATA_CAHPS50.sas` program demonstrates sample SAS code to prepare the data set before the macro run. More resources can be found in [Preparing Data from CAHPS Surveys for Analysis](#) (available on the AHRQ CAHPS web page about [analyzing CAHPS survey data](#)).

The sample code provided in the `TEST_PREPDATA` file is intended to work with the `TEST` data set. You can utilize this code for your own data sets, but will need to make modifications to the statements depending on the variable names and variable response options in your data set.

1. Set permanent or temporary SAS data set.

```
data adult;
set in.test_cahps50;
```

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

```
length plan $ 16 ;
if      planid = 1 then plan = 'PRACTICE_A_URBAN' ;
else if planid = 2 then plan = 'PRACTICE_B_URBAN' ;
else if planid = 3 then plan = 'PRACTICE_C_URBAN' ;
else if planid = 4 then plan = 'PRACTICE_B_RURAL' ;
else if planid = 5 then plan = 'PRACTICE_C_RURAL' ;
```

3. Recodes dichotomous variables from 1-2 to 1-0; such that the largest number represents the most positive response.

```
array org q05      q26;
array rev q05_re  q26_re;

do i = 1 to dim ( rev ) ;
    if org [i] in (1, 2) then rev [i] = 2 - org [i] ;
    else                    rev [i] = . ;
end ;
```

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

```
array org2 q23 q24;
array rev2 q23_re q24_re;

do i = 1 to dim ( rev2 ) ;
if org2 [i] in (1, 2, 3, 4, 5)
then rev2 [i] = 6 - org2 [i] ;
else rev2 [i] = . ;
end ;
```

5. Cleans variables age and general health status for out of range values.

```
age = q25;
ghr = q27;

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

Step 3. Running Macro_CAHPS50.sas—Specifying Parameter Options

This step is divided into two steps. For no post-stratification weighting case, please refer to Step 3a. For post-stratification case, please refer to Step 3b.

Step 3a. No Post-Stratification Weighting Case

The following statement includes the macro code MACRO_CAHPS50.SAS where the path before “Macro_cahps50.sas” is the location of the Macro file.

```
%include "/data/cahps/macros/data/Macro_cahps50.sas" ;
```

Examples of using these arguments with the test data set are provided below.

- * Executes CAHPS macro for the global rating scale variable, with no case-mix adjuster variables.

```
%cahps(
  var      = q18,                /*Name of the variable to be
                                analyzed*/
  vartype  = 2,                /*Set the type of variable: 2 = rating
                                scale(0-10)*/
  name     = Rating Provider,  /*Label for the outcome variable*/
  adultkid = 3,                /*Specify how to analyze child and
                                adult surveys: 3 = analyze adult data
                                only*/
  dataset  = test,            /*Name of the input data set*/
  outname  = rprov           /*Name used for the output data set*/
);
```

- * Executes CAHPS macro for the “How Often” composite measure, with two case-mix adjuster variables; instructs the macro to impute any missing case-mix adjuster variable responses; recodes the 4-point scale to collapse into 1-2|3|4| for 3-part frequency; and uses PROC SURVEYREG for the case-mix model.

```
%cahps(
  var      = q11 q12 q14 q15,    /*Name of variables in the composite
                                measure to be analyzed*/
  vartype  = 3,                /*Set the type of variables: 3 =
                                “never” to “always” (1-4)*/
  recode   = 1,                /*Recode the scale: 1 = 3-part
                                frequency where the 4-point scale is
                                collapsed into 1-2|3|4*/
  name     = Provider Communication
                                Composite measure, /*Label for the outcome variable*/
```

```
adultkid = 3, /* Specify how to analyze child and
               adult surveys: 3= analyze adult data
               only */
Adjuster = age ghr, /*List of case-mix adjuster variables
                   to include*/
impute = 1, /*Flag to impute case-mix adjusters
            that are missing*/
dataset = test, /*Name of the input data set*/
outname = ProvComm /*Name used for the output data set*/
proc_type= 1 /*Specifies the use of PROC SURVEYREG
            for the case-mix model/
);
```

Step 3b. Post-Stratification Weighting Case

To combine data for reporting from different sampling groups, or strata, you must add a text file to the program before the macro run. Some examples illustrate situations in which this feature might be used:

1. Two health plans are merged that were formerly separate and were treated as such in the survey. The two former health plans are the strata, with each assigned a weight to combine for post-stratification into a single health plan score.
2. A health system surveys patients in all their practice sites by urban or rural locations, but the system wants to combine these urban and rural patients into their respective practice sites for reporting.

If stratification is part of your survey design, you must create an ASCII data set with columns separated by one or more spaces for these four variables:

- **Original Plan** – a unique identifier of the entities or strata 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 entities that will be created by combination of strata or post-stratification. 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.
- **Strata Weight** – a numeric variable that indicates the size of the population for the entities or strata. This variable is used to create the weights for combining the strata. 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) in which the entity belongs. 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; each column of data should be separated by spaces. If tabs are used, the Analysis Program may not read in the data correctly. Also, be sure not to have any extra records at the bottom of the ASCII file. Importing an ASCII file into SAS is the only way to add stratification information.

You may use the TEST_CAHPS50_STRATIFIED program as a starting point to create a PLAN detail ASCII file and change variable names and paths as needed.

An example of the PLAN detail data set is provided for the test program (TEST_CAHPS50_STRATIFIED.SAS). The data file is called “plandtal.dat” and looks like the text below:

Table A.1 Sample Data for Post-Stratification Weighting

Origplan (PLAN for each strata)	Newplan (post-stratification PLAN)	stratwgt	Subcode
PRACTICE_A_URBAN	PRACTICE_A	5000	Northeast
PRACTICE_B_URBAN	PRACTICE_B	8000	Northeast
PRACTICE_C_URBAN	PRACTICE_C	15000	South
PRACTICE_B_RURAL	PRACTICE_B	2000	Northeast
PRACTICE_C_RURAL	PRACTICE_C	3000	South

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

After the text file is created, use similar codes in Step 3a to run the macro. In the macro statement, you must set WGTSTAT = 2 to use the post-stratification weighting. For more details, please refer to examples of using these arguments with the test data set in TEST_CAHPS50_STRATIFIED.SAS.

Examples of using these parameter with the test data set are provided below.

- * Executes CAHPS macro with global rating scale variable, case-mix adjusters, and using post-stratification weighting.

```

%cahps (
  var          = q18,          /*Name of the variable to be analyzed*/
  vartype     = 2,            /*Set the type of variable: 2 = rating
                              scale(0-10)*/
  name        = Rating Provider, /*Label for the outcome variable*/
  adjuster    = q25 q23_re,    /* List of case-mix adjuster variables to
                              include */
  adultkid    = 3,            /*Specify how to analyze child and adult
                              surveys: 3 = analyze adult data only*/
  adj_bars    = 1,            /*Flag for the frequencies to be case-mix
                              adjusted*/
  bar_stat    = 0,            /*Flag if case-mix adjusted frequencies
                              should be saved*/
  wgtdata     = 2,            /*Combine strata and conduct post-
                              stratification weighting */
  subset      = 3,            /*Subset case-mix adjustment model for the
                              subset group (North and South) */
  impute      = 1,            /*Flag if impute case-mix adjusters that are
                              missing*/

  dataset     = test2,        /*Name of the input data set*/
  outname     = rprov         /*Name used for the output data set*/
);

```

Contents of the Test Data Set (TEST_CAHPS50_DATA)

Table A.2 lists the contents of the test data set (TEST_CAHPS50_DATA.sas7bdat).

Table A.2 Description of test data set variables based on CAHPS Clinician & Group Adult Survey 3.0

Variable	Description	Response options and Formats
PlanID	Plan identification number	1 = PRACTICE_A_URBAN ; 2 = PRACTICE_B_URBAN ; 3 = PRACTICE_C_URBAN ; 4 = PRACTICE_B_RURAL ; 5 = PRACTICE_C_RURAL ; . = Missing
Q05	Last 6 months, make appointment for an illness, injury with provider	1=Yes 2=No .=Missing 98=Inapplicable 99=No Answer Given
Q06	Last 6 months, how often get appointment for routine care as soon as needed	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q11	Last 6 months, how often provider explains things	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q12	Last 6 months, how often provider listens carefully	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q14	Last 6 months, how often provider shows respect	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given

Variable	Description	Response options and Formats
Q15	Last 6 months, how often provider spends enough time with you	1=Never 2=Sometimes 3=Usually 4=Always .=Missing 98=Inapplicable 99=No Answer Given
Q18	Last 6 months, rate provider	0 (worst) - 10 (best) .=Missing 98=Inapplicable 99=No Answer Given
Q23	Rate overall general health	1=Excellent 2=Very Good 3=Good 4=Fair 5=Poor .=Missing 98=Inapplicable 99=No Answer Given
Q24	Rate overall mental health	1=Excellent 2=Very Good 3=Good 4=Fair 5=Poor .=Missing 98=Inapplicable 99=No Answer Given
Q25	Age	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 98=Inapplicable 99=No Answer Given
Q26	Gender	1=Male 2=Female .=Missing 98=Inapplicable 99=No Answer Given

Variable	Description	Response options and Formats
Q27	Highest education level completed	1=<= 8grade 2=Some high school 3=High school grad/GED 4=Some college/2-yr degree 5=4-yr college grad 6=>4-yr college degree .=Missing 98=Inapplicable 99=No Answer Given

Appendix B. Statistical Explanation of Macro Parameters

This appendix contains detailed explanation of some of the macro parameters. It is divided into three sub-sections:

- Detailed Explanation of Analyses Performed in the CAHPS Analysis Program
- Code Descriptions and Resources
- Detailed Explanation with Statistical Notations (describes how some of the macro parameters are implemented in the Analysis Program)

Detailed Explanation of Analyses Performed in the CAHPS Analysis Program

Case-mix Adjustment

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 more problems with care than do people in better health. Older patients tend to report fewer problems with care than do younger patients, although this association is usually not as strong as the one between health status and ratings. 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, (i.e., perhaps their greater needs create more opportunities for failure). The age association has the same ambiguity. However, regardless of the reason, it is misleading to rate an entity worse simply because of the kind of patients it treats.

In the Analysis Program, if data are missing for an adjuster variable, the program either (at the option of the user) deletes the case or imputes the entity 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.

Sometimes case-mix adjustments may be required for an entity, but for some reason it would not be desirable for the ratings from that entity to affect the estimated case-mix coefficients or the recentering of entity scores. An example in Medicare CAHPS would be where the purpose of the implementation is to make comparisons among Medicare Advantage (MA) plans, but data were also collected for non-MA plans and the survey user wants to include them for comparison without affecting the MA scores. A quick way to implement case-mix adjustment in this instance is to use the case-weighting option. Data from the entities designated not to affect the model are retained in the sample but assigned very small weights (such as 0.0000001, or 0.0000001 times their sampling weights if the data are already weighted). The case-mix model is then applied as usual, using the weights. This trick works because (1) the weights for the designated entities are so small that the associated data have essentially no influence on the fitted model and (2) case-mix adjustment is performed in full irrespective of the weights.

Case Weighting

Weighting arises at three points in the computations performed by the CAHPS Analysis Program: (1) Estimation of case-mix regression coefficients, (2) Calculation of adjusted entity means, and (3) Calculation of overall mean and significance tests of difference from the overall mean.

(1) **Estimation of case-mix regression coefficients.** We may think of this calculation as proceeding in two stages: first calculating sufficient statistics (the statistics for each entity used in calculating the coefficients) for regressions within each entity, and then pooling these estimates across the entities, weighting the sufficient statistics by the corresponding entity weight. The weighting issues in the first stage concern the weights given individual cases in the sufficient statistics for the within-entity regressions, and in the second stage concern the weights used when pooling the within-entity estimates across entities. In general, the within-entity regression estimates will be biased and inconsistent if the weights are related to residuals from the regression, so it is advisable to use the within-entity weights (if they are available) unless it is known that the sampling was conducted in a way that does not create bias if the weights are ignored.

There is more leeway in choice of weights at the entity level when pooling the within-entity estimates. Weighting each entity's statistics by the sum of the case weights of cases in an entity yields estimated coefficients that are representative of the entire population, by weighting the data from each entity by the total population of the entity. While population representativeness is a common objective for analysis of surveys, it has some disadvantages in CAHPS surveys because CAHPS results are reported for *entities* rather than the population as a whole. If a few entities have much larger populations than others, they could dominate estimation of the coefficients in a weighted regression; this could be undesirable because the objective of regression modeling in case-mix adjustment is to estimate a model that fits reasonably well across all the entities being compared, not just the largest ones or the pooled population. Furthermore, such disproportionate weighting is generally less efficient statistically than a weighting that is more uniform, yielding larger variances for the same amount of data. This approach may nonetheless be desirable if the primary goal of the analysis is to obtain nationally representative estimates, for example, for national comparison of subgroups of patient that cut across entities, such as those in different regions or racial/ethnic groups.

Another option is to weight each entity's data equally; this can be implemented by dividing each case's weight by the total weight for the entity. This serves the objectives of CAHPS analyses where the primary objective is to compare entities or to examine effects of entity-level factors, but may be inefficient if the sample sizes per entity vary greatly, especially if some entities have very large samples.

A third weighting option weights each entity by its number of respondents ("precision weighting"); this can be implemented by multiplying each case's weight by the ratio of number of respondents to total weight for the entity. Holding other things approximately equal across entities (such as the residual variance and the within-entity distribution of characteristics), this is statistically the most efficient method. In this option, entities with small samples do not gain disproportionate weight. While the largest entity samples do gain more influence in the regression, in many CAHPS applications the sample sizes are bounded by design (or by limited resources) so a large entity population does not translate into a proportionately large entity influence in the regression. A possible disadvantage of this method is that it depends on the sample design and response/nonresponse patterns, and therefore has no clear population interpretation. Nonetheless, we recommend this as the default option because it is the most robust and often most statistically efficient method.

The final calculation of case (individual) weights for the case-mix regressions can be understood as consisting of three steps:

- First, calculate within-entity weights that sum to 1 in each entity; these are equal to the weights provided to the macro divided by the sum of the weights in each entity.

- Second, calculate entity weights using one of the options defined above.
- Third, multiply the within-entity weights by the entity weights to get the weight used in regression.

(2) **Calculation of adjusted entity means:** Because the entity means are calculated separately for each entity, entity level weights are not relevant to this calculation. On the other hand, for the reasons described above, the within-entity weighting is usually important to calculation of representative estimates of entity means. Thus, we recommend that this calculation use any weights that vary across cases within the same entity, and this is the only option in the Analysis Program.

(3) **Calculation of overall mean and significance tests of difference from the overall mean:** Since this step operates only on the entity means, within-entity weight variation is not relevant here. The definition of the overall mean affects both recentering of the entity means and significance tests of differences from that mean. A complicating circumstance is that for a composite measure, the number of cases or total weight may be different for each of the items going into composite measure. The weighting choices for calculation of the overall mean are to

- a. weight the entity means equally,
- b. use weights equal to the sum of the weights for cases within each entity, which produces an estimate of the combined mean of the entire population of cases, or
- c. use weights equal to the number of observations used in the calculation of the mean (or the total of these numbers across the items of a composite measure).

These options are parallel to the options for entity weighting of case-mix adjustment models, but the two selections are independent.

The choice of method for calculating the overall mean affects the tests of each entity's difference from that mean. For example, if one entity has a much larger enrollment than the others, and also an unusually high mean score, it will pull up the overall mean so it will become more difficult for an entity to demonstrate significantly better performance than average. With equal weighting of entities, the comparison is to the mean of entity means, which generally lies in the "middle" of the entity scores but is not necessarily representative of the combined population of cases.

We recommend choosing between these options based on the interpretation that will be given to the reported overall mean and therefore to the comparison of each entity's adjusted mean to that overall mean. The usual comparisons of entities for quality reporting, incentives, and similar purposes are intended to place each entity in relation to the collection of *entities*; we recommend the *unweighted* mean of entities (equivalent to equal entity level weights) as the appropriate standard of comparison.

Item Weighting – Algorithm for Composite Measures

The CAHPS Analysis Program uses item weights to compute the means of the composite measures for each entity. There are three types of weights that users can select in the EVEN_WGT macro parameter. To use the sum of the number of respondents for the item weights, select EVEN_WGT = 0. The EVEN_WGT = 2 option uses the sum of the individual weights by each item for the item weight. For the EVEN_WGT = 1 option, two methods are available for computation of the item weights. First, 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 measure, the item weight is $1/4 = 0.25$ for each item. An advantage of this approach is that the relative weights of the items in the composite measure are consistent among survey administrations. Furthermore, survey users 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. Thus, the `EVEN_WGT = 1` has an option that solves this problem through down-weighting of low-response items.

Variance Estimation

Variances are calculated for the mean for each entity, 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 composite measures, when the pattern of missing data varies by item. In the interest of consistency, we use the same procedure for both classes of reports.

Code Description and Resources

Case Weighting

Table B.1 lists the types of weight options available in the CAHPS Analysis Program.

Table B.1 List of Macro Weight Options

Phase of estimation	Option	Indications and Advantages	CAHPS Analysis Program options
Regression for case-mix coefficients: within-entity weighting	Use weights	Generally recommended; makes estimates more population-representative and reduces chance of bias due to association of weights with outcomes	Only option allowed if weights are provided (<code>wgtresp</code>)
	Ignore weights	Use when inefficiency of estimation with unequally-weighted data is a problem; consider possible biases first.	Do not provide weights
Regression for case-mix coefficients: entity-level weighting	Population: sum of case weights	When population-weighted regression coefficients are of interest	(<code>wgtresp</code> and <code>wt_type = 2</code>)
	Equal by entity	When primary objective is comparison among entities of equal importance	(<code>wgtresp</code> and <code>wt_type = 1</code>)
	Precision: by number of respondents	Maintain statistical efficiency (precision of coefficients) when responding sample sizes for entities vary greatly	(<code>wgtresp</code> and <code>wt_type = 0</code>)

Phase of estimation	Option	Indications and Advantages	CAHPS Analysis Program options
Calculation of entity means: within-entity weighting	Use individual-level weights	Generally recommended.	Only option allowed if weights are provided (<i>wgtmean</i>)
	Ignore weights	Only if weights are known to be irrelevant.	Do not provide weights
Recentring and tests of adjusted means: entity-level weighting	Preserve and test against unweighted mean of means	Relevant when entities are treated as equal members of population of entities (as in comparisons for quality reporting or incentives)	Unweighted option (<i>overall_wt = 1</i>)
	Population: sum of case weights	Relevant when testing the entity mean against the population mean is desired.	Population weight option (<i>overall_wt = 2</i>)
	Use number of respondents	This is the most efficient weight. It can be used when there is no information about the population.	Number of respondents option (<i>overall_wt = 0</i>)

Table B.2 shows how each type of weight can be calculated.

Table B.2 Case Weighting Used for Case-mix Coefficients

Entity	Survey weight	Within-entity weight= (Survey weight)/ (Entity total)	Weight options / entity total / derived case estimation weights		
			Population weighting of entities	Equal weighting of entities	Precision weighting of entities
			Entity total = sum of survey weights	Entity total=1	Entity total =number of respondents
Hxxxx	30	30/180=.1667	30	0.1667	0.833
Hxxxx	30	30/180=.1667	30	0.1667	0.833
Hxxxx	40	40/180=.2222	40	0.2222	1.111
Hxxxx	40	40/180=.2222	40	0.2222	1.111
Hxxxx	40	40/180=.2222	40	0.2222	1.111
Entity Hxxxx total and Weight in estimation	180	1	180	1	5
Hyyyy	30	30/80=.3750	30	0.375	1.125
Hyyyy	30	30/80=.3750	30	0.375	1.125
Hyyyy	20	20/80=.2500	20	0.25	0.75
Entity Hxxxx total and Weight in estimation	80	1	80	1	3

Explanation of weight calculation:

1. **Survey weight** is entered by the user as a variable in the input data set. It may incorporate sampling, nonresponse, and/or post-stratification weights. If no weights will be used, this is set to 1 for every responding case. The macro calculates the sum of each respondent's weight for each entity.
2. **Within-entity weight** is the fraction of the entity's total weight that is assigned to a specific case, defined as the survey weight of the observation divided by the entity sum of these weights.
3. The total **estimation weight** in each entity is determined by the entity weighting option chosen (gray cells).
 - a. For each entity, this weight is allocated to the observations in the entity in proportion to its within-entity weight. For population weighting, this recovers the original survey weights.
 - b. Because the number of responses may vary across items, these calculations are repeated for each item.

Item Weighting – Algorithm for Composite Measures

When each item weight is assigned equally by selecting the equal weight option (EVEN_WGT = 1) to calculate the composite measure mean, a problem may arise if some of the items have low responses. To solve this problem, the even weight option has a method to assign the item weight by downweighting low-response items.

The first modification is motivated by the fact that responses to different items in the same composite measure often have different mean values for a variety of reasons, including how frequently problems arise in different kinds of interactions and services and how the questions are worded. If the items are weighted the same way for every entity to calculate the composite measure, the effect of these unequal means across entities is minimal. However, if the items are not weighted equally, this could give rise to variations unrelated to variations in quality.

Thus, we first modify the calculation of weighted composite measures to minimize the impact of such differences in item means on expected scores. To explain the need for this modification, suppose y_i is the mean score for item i at a given entity, and μ_i is the mean score for item i across all entities. With weights w_i that sum to 1, the composite measure score is $\sum_i w_i y_i$ for a specific plan, and if that plan is at the average on all measures, its score is $\sum_i w_i \mu_i$. If the overall means μ_i differ, this last expression will depend on w_i ; in other words, even two plans that are average on every measure will receive different composite measure scores if the composite measures are calculated with different weights.

To remove this dependence, we center the scores at their means before combining them. Suppose now that w_i represents the weight for item i at a particular entity, and w_{0i} represents some standard weights common to the entire report. Now define a composite measure score as

$$\left[\sum_i w_i (y_i - \mu_i) \right] + \left[\sum_i w_{0i} \mu_i \right].$$

Any entity that is average ($y_i = \mu_i$) on every item will receive the same composite measure score $\sum_i w_{0i} \mu_i$

regardless of the weights w_i , so bias due purely to weighting is removed even if different entities are scored with different weights. Note that the second term of this composite measure score expression is the same for every entity; it is included only to bring the average back to an interpretable level as an average score of overall means.

Given this modification, we can now consider modifying item weights for different entities. The main requirement is that the weight must be zero ($w_i=0$) when there are no responses for item i ; we also want the weights to be equal (or at least to approach equality) when there is “adequate” sample for every item.

One simple weighting mechanism meeting these requirements is as follows:

- Set $w_{i0}=1/I$, $i=1, \dots, I$, where I is the number of items in the composite measure.
- Choose a cutoff number of observations K ; weights will not be modified for items with at least K observations.
- Define entity-specific weights $w_i = \min(n_i, K) / \sum_{i'=1, \dots, I} \min(n_{i'}, K)$, where n_i is the number of responses from the entity for item I , and $\min(n_i, K)$ is the lesser of n_i and K .
- Calculate composite measure scores as described above.

This procedure has the following desirable properties:

- For each entity, all items with at least K responses are given equal weight. Consequently, there is no modification to equal item weighting for entities with large samples.
- Items with no responses in a given entity are given no weight, so the composite measure score can still be calculated.
- Items with low numbers of responses ($<K$) are given reduced weight so their effect on variance is mitigated.
- The criterion for determining whether an item will be downweighted is very simple to describe.

The procedure can easily be modified for unequal baseline weights w_{i0} .

Table B.3 illustrates the calculation of item weights for various scenarios in a composite measure with three items, assuming that the target minimum sample size $K=20$.

Table B.3 Examples of a composite measure with three items using a macro parameter K

Sample sizes n_i	$\min(n_i, K)$	Calculation of weights w_i	Weights w_i simplified	Interpretation
60, 70, 80	20, 20, 20	20/60, 20/60, 20/60	1/3, 1/3, 1/3	Every item has adequate sample so equal weighting is OK.
0, 22, 24	0, 20, 20	0/40, 20/40, 20/40	0, 1/2, 1/2	Item with no responses gets no weight.
10, 22, 34	10, 20, 20	10/50, 20/50, 20/50	1/5, 2/5, 2/5	One item has low response and is downweighted.
2, 3, 5	2, 3, 5	2/10, 3/10, 5/10	2/10, 3/10, 5/10	If all samples are small, weight each item proportional to the number of responses to improve the efficiency of estimation.

Table B.4 illustrates the calculation of the “centered” weighted average in an entity in which one item of the composite measure has few responses (third line of table above), again assuming $K=20$.

Table B.4 Examples of composite measure with three items using a macro parameter K and means

Description	Symbol	Item 1	Item 2	Item 3
Baseline equal weighting	w_{i0}	1/3	1/3	1/3
Overall (all entities) mean	μ_i	3.45	2.75	2.65
Mean in a specific entity	y_i	3.55	2.80	2.75
Sample sizes in that entity	n_i	10	22	34
Weights in that entity	w_i	1/5	2/5	2/5
Centered entity means	$y_i - \mu_i$	0.10	0.05	0.10

The baseline weighting is assumed to be equal for the three items. Thus, the overall mean composite measure score is $(3.45+2.75+2.65)/3 = 2.95$.

Because at the specific entity of interest there are only 10 responses for Item 1, it is given half the weight of each of the other items. The weighted mean for the entity is then $(1/5) \times 3.55 + (2/5) \times 2.80 + (2/5) \times 2.75 = 2.93$. Note that this is below the overall mean composite measure score, despite the fact that the entity is above the mean on each item, because the item that generally has a high score is downweighted.

To calculate the score by the proposed method, we first calculate the centered means (last line of table), which are all positive. Their weighted mean is $(1/5) \times 0.10 + (2/5) \times 0.05 + (2/5) \times 0.10 = 0.08$. We then add this mean deviation from mean and add it to the overall mean, $0.08 + 2.95 = 3.03$, which is the reported score. This correctly reflects the superiority of this entity across all the items.

Detailed Explanation with Statistical Notations

Case-mix adjustment

Let y_{ipj} represent the response to item i of respondent j from entity 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 β_i is a regression coefficient vector, x_{ipj} is a covariate vector consisting of two or five adjuster covariates (as described above), μ_{ip} is an intercept parameter for entity p , and ε_{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

$$\mathbf{X} = \begin{pmatrix} \mathbf{X}_a & u_1 & u_2 & \dots & u_p \end{pmatrix}$$

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 entity p , $p = 1, 2, \dots, P$, with entries equal to 1 for respondents in entity 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 entity means \bar{y}_{ip} (to make it easier to compare adjusted and unadjusted means), giving adjusted entity means

$$\hat{\mu}_{ip} = \hat{\mu}^*_{ip} + \sum_p w_p (\bar{y}_{ip} - \hat{\mu}^*_{ip}) / \sum_p w_p,$$

where w_p is the sum of the response weights for each entity p and $\hat{\mu}^*_{ip}$ is the adjusted entity mean before recentering.

For single-item responses, these adjusted means are reported. For composite measures, the several adjusted entity means are combined with equal item weights (one divided by the number of items as default), that is, by calculating the mean across items.

Variance of difference from national mean

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

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

where β_i is the regression coefficient vector for item i and y_{ipj} is the response to item i from person j in entity p . The adjusted mean $\hat{\mu}_{ip}$ for entity p , item i , is the mean (across nonmissing observations) of z_{ipj} . u_{ipj} is defined by the weight for item i from person j in entity p . If we replace $u_{ipj} z_{ipj}$ 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

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

and the composite measure score for the entity is

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

where w_i is the composite measure item weight for item i . 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:

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

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

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

where n_p is the number of respondents from entity p . This gives an estimate of a variance of the composite measure score for entity p . If the composite measure 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 or patients who are in entity p at the present time. Our concern, however, is with predicting the mean rating that would represent the experiences of a new set of subscribers or patients joining or seeking care at the entity, because we are attempting to give guidance to those who are considering anew their choice of insurance or treatment site. Conceptually, we regard the present members as a sample from a super-population of potential users of the entity.

Global F-test

The weighted grand mean is calculated as

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

where g_p is the weight from entity p . 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 entity) 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 entity differences from mean

We compare each entity mean to the mean of the entity 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 \sum^* represents a sum over all entities except entity p . Note that the last expression is simply $(P-1)/P$ times the difference of $\hat{\mu}_p$ from the mean of all entities except entity p ; therefore, the two formulations (mean vs. mean of all, or mean vs. mean of all others) are equivalent. The variance of Δ_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.

Appendix C. 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/entity 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/entity 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 **composite measures 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 measure calculation if the number of variables is greater than one. This change was made to accommodate the need to create composite measures from questions with dichotomous and trichotomous variables. The program can now create composite measures using all variable types used in the survey
- The **weighting of the composite measure 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
Option 1:			
0 – 6	1	1 – 2	1
7 – 8	2	3	2
9 – 10	3	4	3
Option 2:			
0 – 7	1		
8 – 9	2		
10	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 added the following enhancements and changes:

- The plan detail file, `plandtal.dat`, and the filename statement that assigns `PLAN_DAT` are optional. If the plan detail file does not exist, then the macro uses the `PLAN` variable in the data set 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 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 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 can apply individual level weights to the composite measure 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`, was added to the text output of the adjusted mean report.
- A CAHPS version label was added to the permanent data sets to indicate which version of the CAHPS Analysis Program created the data set. The version number was also added to the text output.
- Users can 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 were 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`.

- Two flag lines added to the log file indicate if the macro finds the CHILD and PLAN variables in the original analysis data set. If there is no child variable, the flag indicates how the macro created a new CHILD variable.

Version 3.4 (May-June 2003) of the CAHPS SAS Analysis Program added 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 $1.96 * \text{the standard error of the difference}$. 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* data set 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.
- Expanded the purpose of the wgtmean parameter to allow 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 data set. 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 an entity 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 an entity'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 or entity 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 entity 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 _WGTPLAN 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.

Version 4.0 (September 2011) and **4.1** (April 2012) of the CAHPS SAS Analysis Program added the following enhancements and changes:

- One part of the code that creates plandtal data set (it is in usable macro program) was modified. This only affects when subset = 3.
- The calculation of weights for the composite measure items was modified. The sum of weights based on the number of responses from each item is used as the weight of the composite measure case. Also, the calculation of item weights for even_wgt = 1 was modified. For more details about how the weights are computed, please see the *Explanation of Statistical Calculation* section.
- A new warning note was added in the macro output (it is in . mkreport macro program). The note lists plan IDs when they have zero responses in measured items. A new option of assigning smoothing variances was added. Users can assign a weight parameter called *smoothing* on the variances as option. The default is *smoothing* = 0. This provides the original variances. If *smoothing* is greater than zero, the value that users input will be used as the weight for the variances. If *smoothing* is less than zero, the weight will be computed inside of the macro automatically. For more details about how that weight is computed inside of the macro, please see the *Explanation of Statistical Calculation* section.
- A SAS procedure PROC STANDARD was replaced with PROC STDIZE. The macro centers all adjusters before it runs regression procedure if adjusters are required. PROC STANDARD was

not applicable when some adjusters contain only the same values. As a result, it did not standardize the value correctly. PROC STDIZE is able to handle the situation.

- (April 2012) Modified codes for computing adjusted composite measure means when composite measure even weight option (`even_wgt = 1`) is selected. The macro computes the weights for all entities regardless of the sample size. In the prior version, this caused incorrect adjusted means when some entities did not make it to the final analysis due to the sample size. Thereby the weights can be assigned differently in each item depending on the value K. Users can assign the least responses in each composite measure item called K. . Version 4.1 is able to handle the case and provide appropriate adjusted means.

Version 5.0 (November 2016) of the CAHPS SAS Analysis Program added the following enhancements and changes:

- (November 2016) Updated weighted variance estimation. This update to the CAHPS macro corrects an error in the previous version, which failed to take differential weighting at the individual level into account in variance estimation. Mean scores were not affected by this update.
- (February 2017) Added new weight option for calculating of case-mix regression coefficients (`WT_TYPE`). One option (`WT_TYPE = 1`) is to weight equally by entity. The other option (`WT_TYPE = 2`) is used when population-weighted regression coefficients are of interest. The default (`WT_TYPE = 0`) is to weight by number of respondents.
- (February 2017) Added weighted overall mean option (`OVERALL_WT`). `OVERALL_WT = 0` uses number of respondents, `OVERALL_WT = 1` assigns equal weight, and `OVERALL_WT = 2` uses the plan weight assigned in `&WGTPLAN`, which is the default in the program.
- (February 2017) Modified the default value of suppressing results of regression models (`OUTREGRE`). The default value is updated to be 1 instead of 0.
- (February 2017) Added `VARDEF` option to PROC MEANS. This affects the calculation of weighted standard deviation.
- (February 2017) Added PROC SURVEYREG as one of the regression options (`PROC_TYPE`). Users can select either PROC REG or PROC SURVEYREG. The SURVEYREG procedure is designed to handle complex survey sample designs, and one of the designs, clustering option, was added to the version 5.0. Selecting `PROC_TYPE = 1` performs PROC SURVEYREG. The default is `PROC_TYPE = 0`, which is PROC REG used for the regression.
- (February 2017) Updated the content of the case-mix regression coefficients output file (`C_&OUTNAME`). The output contains the standard errors, the p-values for each of the case-mix estimates.
- (February 2018) Modified the composite measure calculation. Each overall mean of the items gets computed first before combining the composite measure mean.
- (January 2019) Modified the Test SAS data set to change from the Health Plan Survey version 4.0 to the Clinician & Group Survey version 3.0.
- (June 2020) Modified all test programs to correspond with the updated Test SAS data, and clarified instructions. Numbered programs to delineate which should be run first and separated the steps required to prepare the data for analysis from the macro call statements.