AHRQ Quality Indicators[TM]

QUALITY INDICATORS SOFTWARE INSTRUCTIONS, SAS QI®
Version 5.0

Prepared for:

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Contract No. HHSA290201200001C

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March 2015

Abstract

The Agency for Healthcare Research and Quality (AHRQ) Quality Indicators™ (QIs) were developed specifically to meet the need for short-term information on health care quality using standardized, user-friendly methods and existing sources of data. The AHRQ QIs program is unique in that it provides free, publicly available software tools that allow users to calculate the AHRQ QI rates based on their own administrative data using a standard personal computer. Each version of the QIs is released with software in two different platforms: a SAS®* application and a Windows® application. The SAS software was first released in the late 1990s. It consists of several modules of SAS code and requires a SAS license to run. The Windows-based software, known as WinQI, was first released in 2005. It was created to provide an easy-to-use, low-cost option for calculating the QIs that is not dependent on licensed software. Developed on Microsoft® Visual Studio using C# and .NET, AHRQ WinQI runs on the Windows operating systems and requires only freely available software components: AHRQ-produced software, Microsoft.NET (for runtime environment and core software libraries), and Microsoft SQL Server® Express (for data storage and manipulation). Table 1 lists the differences between SAS QI Version 5.0 and WinQI Version 4.5. Both the SAS QI and WinQI software are available as either 32-bit or 64-bit applications. The 32-bit applications are targeted for Windows XP operating systems, and the 64-bit applications are targeted for Windows 7 operating systems.

Table 1. Differences Between SAS QI v5.0 and WinQI v4.5

SAS QI v5.0	WinQI v4.5
Requires licensed SAS software	Requires free, downloadable software
User can modify the software	User is unable to modify the software
Data load and error checking at the discretion of the user	Includes data load and error checking functions
User must run a set of programs for each module, and all indicators in a module are displayed in output	All four QI modules are calculated in a single program, and user can select which indicators to output
Area-level indicator denominators are adjusted based on the combination of county, age, gender, and race in the numerator (adjustments are generally small [<0.01% in absolute terms])	Area-level indicator denominators are not adjusted
Condition-specific denominators can be used in place of overall population denominators for diabetes-related PQIs) using data from the National Diabetes Surveillance System	Condition-specific denominators are not available for any of the PQIs
	Suppresses expected rate, risk-adjusted rate, and smoothed rate of PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate

CDC: Centers for Disease Control and Prevention; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; QI: Quality Indicator; RACHS-1: risk adjustment for congenital heart surgery; WinQI: QI Windows®

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Both versions of the QI software are updated on an annual basis to reflect changes in the AHRQ QI technical specifications. New software versions and updated technical specifications are released simultaneously. Routine annual updates include yearly changes based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), Medicare Severity Diagnosis-Related Groups (MS-DRGs), and Major Diagnostic Categories (MDC); an updated version of the 3M™ All Patient Refined Diagnosis-Related Group (APR-DRG) grouper; new Census population files; and newly derived risk adjustment parameters.

The AHRQ QIs are organized around four collections (modules) of indicators: Inpatient Quality Indicators (IQIs), Pediatric Quality Indicators (PDIs), Prevention Quality Indicators (PQIs), and Patient Safety Indicators (PSIs). Data captured by and characteristics of each of the modules are shown in Figure 1. Detailed definitions of each indicator, with complete listings of ICD-9-CM and MS-DRG codes specifically included or excluded, are contained in the AHRQ QI technical specifications. The AHRQ QI software and supporting documentation can be found on the AHRQ QIs Web site: (http://www.qualityindicators.ahrq.gov/Software/SAS.aspx).

Additional data on the magnitude of each indicator across an aggregation of Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) files can be found in the Inpatient Quality Indicator v5.0 Benchmark Data Tables, Pediatric Quality Indicator v5.0 Benchmark Data Tables, Prevention Quality Indicator v5.0 Benchmark Data Tables, and Patient Safety Indicator v5.0 Benchmark Data Tables documents. See Appendix A for links to these documents as well as additional documentation on the AHRQ QIs.

Figure 1. Characteristics of AHRQ QI Modules

IQIs	PDIs	PQIs	PSIs
• *Volume* of certain intensive, high-technology, or highly complex procedures for which evidence suggests that institutions performing more of these procedures may have better outcomes • *Mortality* for inpatient procedures and for inpatient conditions • *Utilization* indicators, which examine procedures whose use varies significantly across hospitals and for which questions have been raised about overuse, underuse, or misuse	• Selected indicators from the other three modules with adaptations for use among children and neonates to reflect **quality of care inside hospitals**, as well as **geographic areas**, and to **identify potentially avoidable hospitalizations**	• **Potential health care quality problem areas** that might need further investigation • Measure of **primary care access** or outpatient services in a community using patient data found in a typical hospital discharge abstract	• **Potentially preventable complications** and iatrogenic events for patients treated in hospitals • **Screening tool** for problems that patients experience as a result of exposure to the health care system and that are likely amenable to prevention by changes at the system or provider level

IQI: Inpatient Quality Indicator; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; PSI: Patient Safety Indicator

This document contains the instructions for the SAS QI v5.0 software, which is provided for download on the AHRQ QIs Web site: (http://www.qualityindicators.ahrq.gov/Modules/default.aspx). The software was developed in SAS 9.3 for use on a personal computer. AHRQ's goal, by making this tool publicly available, is to assist users in producing information on health care quality more cost effectively.

The SAS program files are organized by module, and the user must execute the files separately for each of the modules. This document will discuss the code for all four modules of indicators as well as the addition of two standalone software modules to calculate two individual measures. Throughout the document, where there are differences in the software modules they will be highlighted and discussed accordingly.

The AHRQ QI software is intended to be used with data that cover an entire patient population (e.g., all discharges from a hospital in a year) or that were sampled from a patient population using simple random sampling. The SAS QI software, beginning with Version 4.1, does not support weighted QI estimates or standard errors for weighted estimates. Thus, analyses using data obtained from a complex sampling design will not produce accurate estimates for the population from which the data were sampled. For a more thorough description of weighted AHRQ QI analyses, see Guidance for Using the AHRQ Quality Indicators with the Nationwide Inpatient Sample and Other Complex Sampling Designs, available on the AHRQ QIs Web site.

Acknowledgments

The Agency for Healthcare Research and Quality (AHRQ) Quality Indicators™ (QIs) program uses the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) for 2012 to compute reference population data. HCUP is a family of health care databases and related software tools and products developed through a Federal-State-industry partnership and sponsored by AHRQ. HCUP databases bring together the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal Government to create a national information resource of encounter-level health care data. HCUP databases comprise the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. These databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to health care programs, and outcomes of treatments at the national, State, and local market levels. The HCUP SID encompass about 97 percent of all annual inpatient discharges in the United States.

The AHRQ QIs program would like to acknowledge the HCUP partner organizations that participated in the HCUP SID:

Alaska State Hospital & Nursing Home Association
Arizona Department of Health Services
Arkansas Department of Health
California Office of Statewide Health Planning and Development
Colorado Hospital Association
Connecticut Hospital Association
Florida Agency for Health Care Administration
Georgia Hospital Association
Hawaii Health Information Corporation
Illinois Department of Public Health
Indiana Hospital Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Louisiana Department of Health and Hospitals
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts Center for Health Information and Analysis
Michigan Health & Hospital Association
Minnesota Hospital Association (provides data for Minnesota and North Dakota)
Mississippi State Department of Health
Missouri Hospital Industry Data Institute
Montana MHA…An Association of Montana Health Care Providers
Nebraska Hospital Association

Nevada Department of Health and Human Services
New Hampshire Department of Health and Human Services
New Jersey Department of Health
New Mexico Department of Health
New York State Department of Health
North Carolina Department of Health and Human Services
North Dakota (data provided by the Minnesota Hospital Association)
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Oregon Office of Health Analytics
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina Revenue and Fiscal Affairs Office
South Dakota Association of Healthcare Organizations
Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health Services
Wyoming Hospital Association

For more information on HCUP, visit http://www.hcup-us.ahrq.gov.

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1.0 Introduction

This document describes the Quality Indicators™ SAS® Version 5.0 (SAS QI v5.0) software and highlights features of the analytic approach that may be of particular interest to new users. The SAS QI v5.0 software consists of four main modules and two standalone modules:

- Inpatient Quality Indicators (IQI) Module

- Pediatric Quality Indicators (PDI) Module

  – PQI 09 Standalone Module

- Prevention Quality Indicators (PQI) Module

- Patient Safety Indicators (PSI) Module

  – PSI 17 Standalone Module

The two standalone modules calculate select QIs without the need to run the full module.

The Agency for Healthcare Research and Quality (AHRQ) QI software is intended to be used with data that cover an entire patient population (e.g., all discharges from a hospital in a year) or that were sampled from a patient population using simple random sampling. Beginning with SAS QI Version 4.1, the software does not support weighted QI estimates or standard errors for weighted estimates. Thus, analyses using data obtained from a complex sampling design will not produce accurate estimates for the population from which the data were sampled. For a more thorough description of weighted AHRQ QI analyses, see the technical documentation on the AHRQ QIs Web site.

SAS QI v5.0 consists of one additional program that assists in the calculation of the AHRQ QIs. The Limited License edition of the 3M™ All Patient Refined Diagnosis-Related Group (APR-DRG) Version 32 grouper software (APR-DRG grouper) creates Diagnosis-Related Group (DRG) categories and associated risk-of-mortality data elements. Discontinued in SAS QI v5.0 is the use of the Prediction Module, which estimated the prevalence of conditions when present on admission (POA) data were missing. When using the SAS QI v5.0 software, the user must specify whether the input data has POA information or not. Beginning with Fiscal Year 2008 (October 1, 2007), the Uniform Billing Claim Form 04 (UB-04) data specification manual includes a POA indicator. The POA data may impact the prevalence of the outcome of interest and the risk-adjusted rates by excluding secondary diagnoses coded as complications from the identification of covariates. If the user's input file does not include POA data, the QI software will assume the outcome of interest occurred in the hospital.

The reference population data used by the software are based on the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) for 2012. These databases were used to create the regression coefficients applied to risk adjustment (see Section 7.4) and the shrinkage factors used to calculate smoothed rates (see Section 7.5).

The programs documented here were developed for use with SAS.[†] SAS QI v5.0 is designed as a personal computer–based, single-user application. It has been tested with SAS 9.3 (installed in 64-bit native mode and 32-bit compatibility mode) on 64-bit machines running Windows® 7 Professional and on 32-bit machines running Windows XP Professional (2002). To use SAS QI v5.0, users must have access to a commercially available SAS statistical software package, including Base SAS, SAS/STAT, and SAS/ACCESS. AHRQ is releasing two configurations of SAS QI v5.0—a 32-bit and a 64-bit version. If users are running SAS 32-bit, then they must download and install the corresponding 32-bit components from the AHRQ QIs Web site; i.e., APR-DRG grouper. If users are running SAS 64-bit, then they must download and install the corresponding 64-bit components from the AHRQ QIs Web site; i.e., APR-DRG grouper.

1.1   Naming Conventions of Programs

Most of the SAS QI v5.0 program files use the naming format of *XX*SASi, *XX*SASAi, or *XX*SASPi. The first two characters, denoted here as *XX*, will be designated as "IQ" to indicate an IQI program, "PD" to indicate a PDI program, "PQ" to indicate a PQI program, or "PS" to indicate a PSI program. The next three characters of the program name are "SAS." Figure 2 illustrates the program naming convention in the IQI module.

Figure 2. Program Naming Convention in the IQI Module

IQSASA2.SAS

IQ=Inpatient Quality Indicator	A=Area level	1=first program
PD=Pediatric Quality Indicator	P=Provider level	**2=second program**
PQ=Prevention Quality Indicator		3=third program
PS=Patient Safety Indicator		
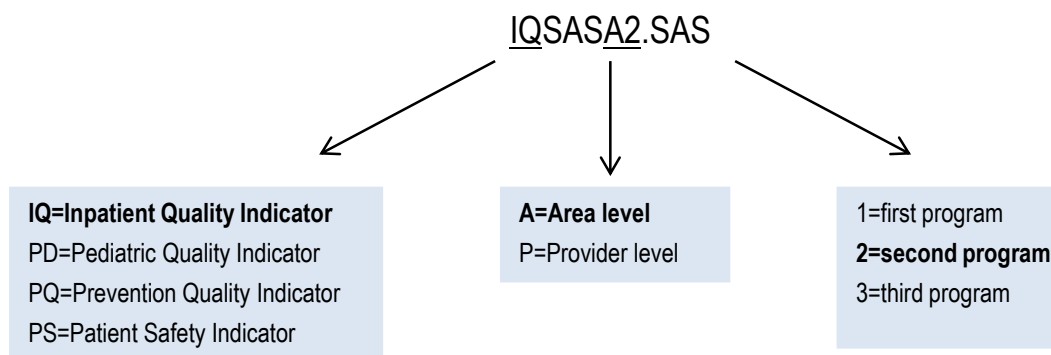
In the programs that are specific to either area-level or provider (facility)–level indicators, the sixth character of the program name is either "A" or "P." The sixth character is an "A" if the program is for the calculation of area-level indicator rates that use county- or Office of Management and Budget (OMB)–defined metropolitan area populations as denominators. The sixth character is a "P" if the program is for the calculation of provider-level indicator rates that use subsets of the hospital discharge population. The PSI, IQI, and PDI modules have both provider-level and area-level indicators, but the PQI module contains only area-level indicators. See Appendix E for a list of provider-level and area-level indicators. The last character ("i") of the file name designates the number of the specific program.

[†]SAS is a statistical software package distributed by the SAS Institute, Inc. The company may be contacted directly regarding the licensing of their products. The SAS Institute, Inc., has no affiliation with AHRQ or involvement in the development of the AHRQ QIs. For more information, visit the SAS Institute Web site at http://www.sas.com.

Composite programs utilize a different naming convention. These programs begin with the module name using the format *XX*I, then continue with "_COMPOSITE." For example, the IQI composite indicators are calculated by the "IQI_COMPOSITE.sas" program.

1.2 Supporting Documentation

The Inpatient Quality Indicator v5.0 Benchmark Data Tables, Pediatric Quality Indicator v5.0 Benchmark Data Tables, Prevention Quality Indicator v5.0 Benchmark Data Tables, and Patient Safety Indicator v5.0 Benchmark Data Tables documents provide benchmark values, including average volumes, provider rates, and population rates, across an aggregation of discharges across an aggregation of SID State files, depending on the type of indicator. In addition, the technical specifications document for each indicator lists all of the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and Medicare Severity Diagnosis-Related Group (MS-DRG) codes included in, and excluded from, the numerator and denominator of each indicator. See Appendix A for links to these and other documents as well as to other relevant Web sites. See Appendix B for an explanation of observed, expected, risk-adjusted, and smoothed rates and for guidance in the use of these rates.

The main body of this document includes a discussion of the data elements necessary to calculate the AHRQ QIs, the uniform coding conventions recommended for those data elements, descriptions of the processing steps in nontechnical language, and detailed descriptions of the functions of each SAS program.

1.3 Saving the Required Files To Run the SAS QI v5.0 Software

Download the SAS QI v5.0 software from the AHRQ QIs Web site into a directory on your computer (e.g., "C:\AHRQQI\"). Create subfolders named for each of the modules (i.e., "IQI," "PDI," "PQI," and "PSI"). The CONTROL.SAS program included with each will need to be modified with the directory names you have used. Editing of the CONTROL files is described in subsequent sections of this document.

2.0 Components of the SAS® QI v5.0 Software Modules

As shown in Figure 3 below, each of the SAS QI® v5.0 main modules consists of various SAS programs and auxiliary data in American Standard Code for Information Interchange (ASCII) text files and comma-separated value (CSV) format. These programs and text files are described in the subsequent sections of this document.

Figure 3. SAS Programs and ASCII Text Files for SAS QI v5.0 Software Components

IQIs	PDIs	PQIs	PSIs
• 9 SAS programs • 6 ASCII text files • 48 CSV files	• 10 SAS programs • 9 ASCII text files • 24 CSV files	• 7 SAS programs • 5 ASCII files • PQI 09 Standalone Module	• 8 SAS programs • 8 ASCII text files • 36 CSV files • PSI 17 Standalone Module
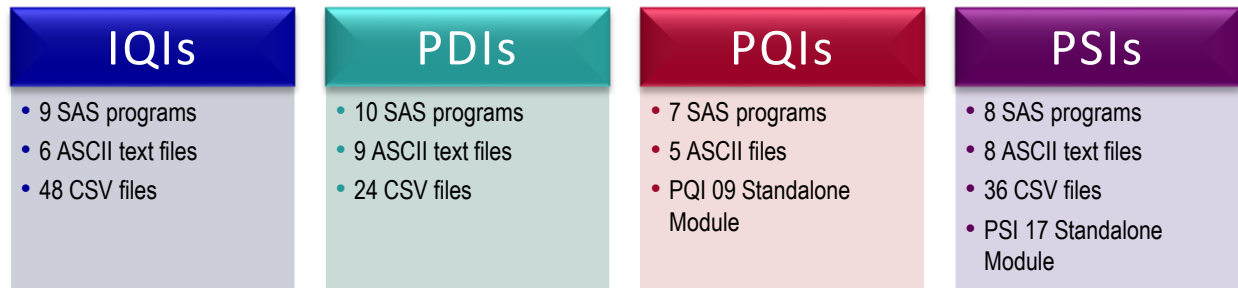
ASCII: American Standard Code for Information Interchange; CSV: comma-separated value; IQI: Inpatient Quality Indicator; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; PSIs: Patient Safety Indicator

3.0   Quick References

This section provides a set of module-specific quick references to assist in reading this instructions document and in reviewing the SAS QI® v5.0 outputs. Processing steps are shown on the first few pages of each reference set, followed by tables explaining the variable naming convention and files used in each module.

3.1   Inpatient Quality Indicators (IQIs) Quick Reference

Figure 4 shows the processing steps for the provider-level indicators in the IQI module, and Figure 5 shows the processing steps for the area-level indicators in the IQI module. Table 2 lists the indicators calculated in the IQI module, arranged by provider level or area level.

Figure 4. Processing Steps for the Provider-Level Indicators in the IQI Module
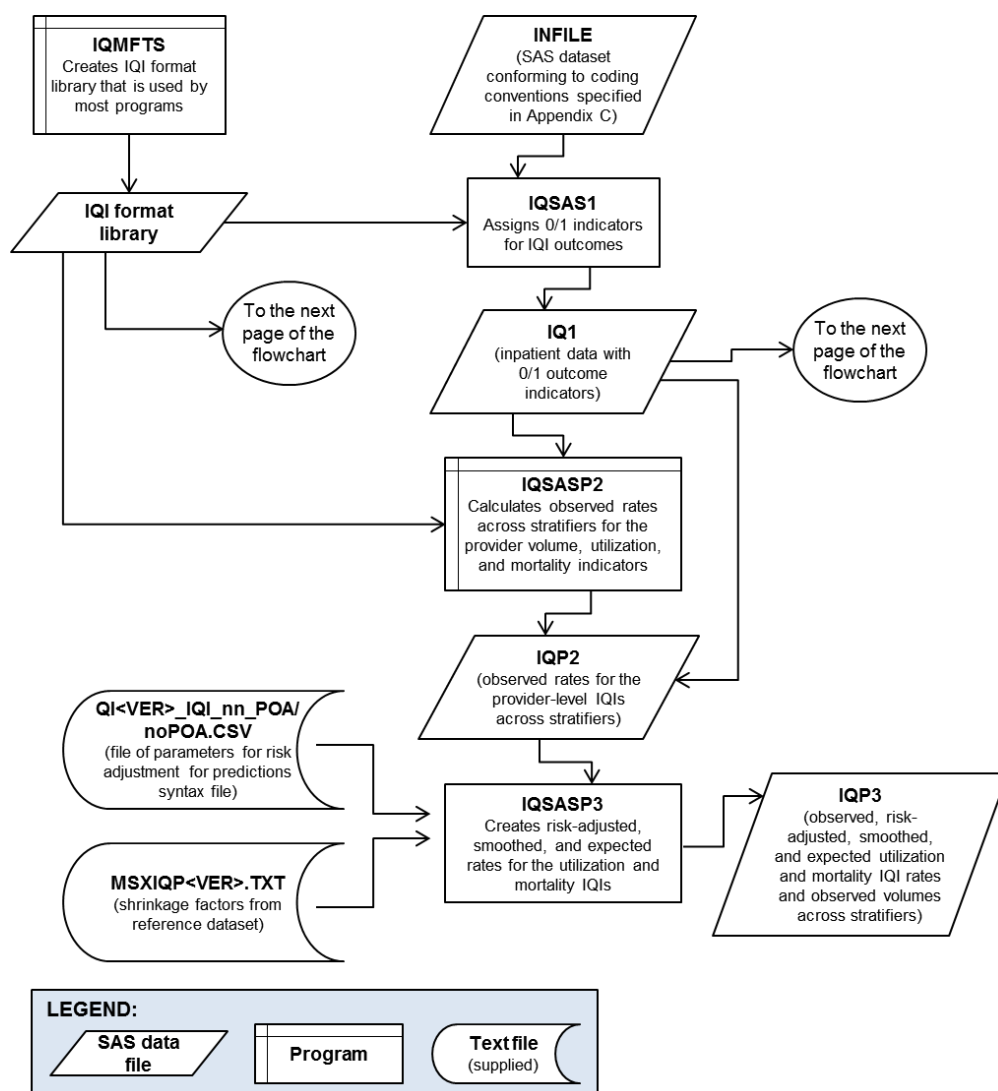
Note: Each of the SAS programs in this figure incorporates the CONTROL_IQI.SAS program, which contains code the user must modify in order to run the IQI software. The modifications include, for example, specifying the name and location of the input, population, and output datasets.
IQI: Inpatient Quality Indicator

Figure 5. Processing Steps for the Area-Level Indicators in the IQI Module
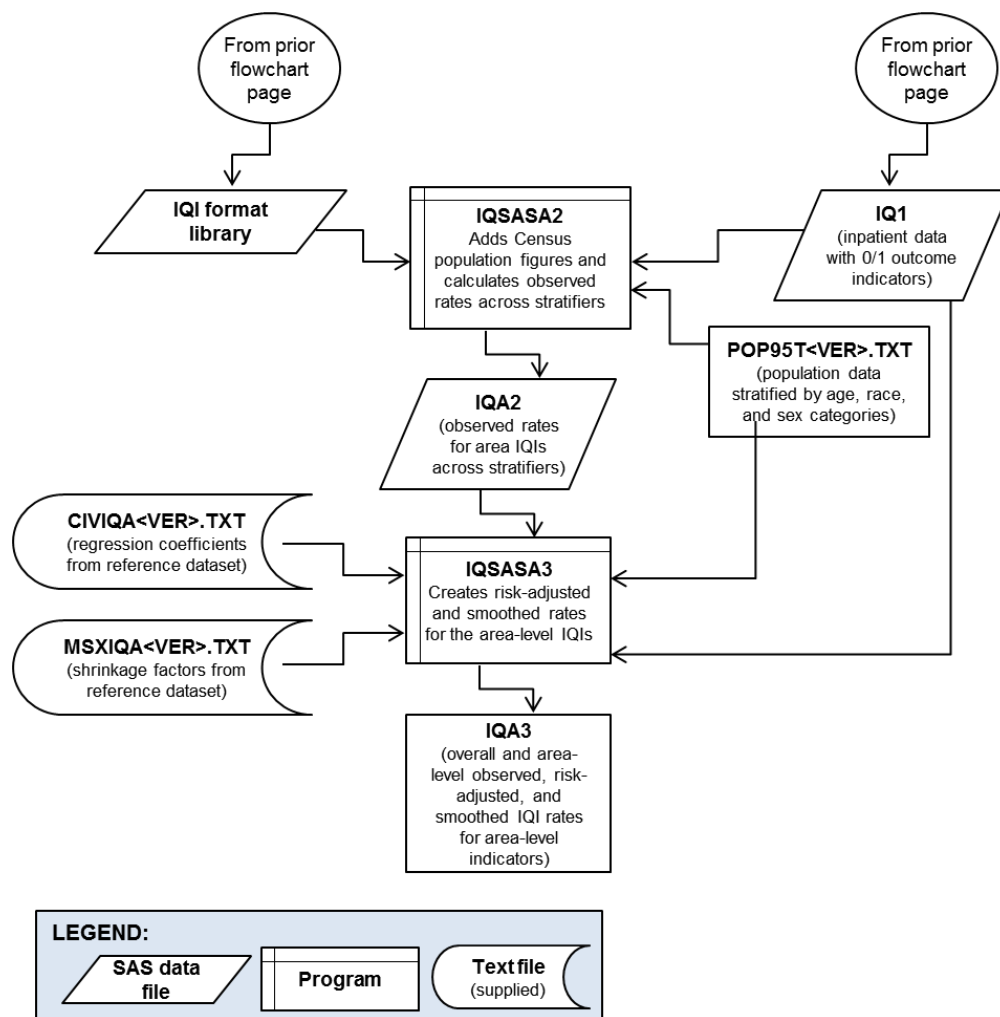
Note: Each of the SAS programs in this figure incorporates the CONTROL_IQI.SAS program, which contains code the user must modify in order to run the IQI software. The modifications include, for example, specifying the name and location of the input, population, and output datasets. IQI: Inpatient Quality Indicator

Table 2. Indicators Computed in the IQI Module and Variable Abbreviation

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
PROVIDER-LEVEL INDICATORS	
IQI 01 Esophageal Resection Volume	IQ01
IQI 02 Pancreatic Resection Volume	IQ02
IQI 2A Pancreatic Resection Volume – Stratum A	IQ02A
IQI 2B Pancreatic Resection Volume – Stratum B	IQ02B
IQI 04 Abdominal Aortic Aneurysm (AAA) Repair Volume	IQ04
IQI 4A Abdominal Aortic Aneurysm (AAA) Repair Volume – Stratum A	IQ04A
IQI 4B Abdominal Aortic Aneurysm (AAA) Repair Volume – Stratum B	IQ04B
IQI 4C Abdominal Aortic Aneurysm (AAA) Repair Volume – Stratum C	IQ04C
IQI 4D Abdominal Aortic Aneurysm (AAA) Repair Volume – Stratum D	IQ04D

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
IQI 05 Coronary Artery Bypass Graft (CABG) Volume	IQ05
IQI 06 Percutaneous Coronary Intervention (PCI) Volume	IQ06
IQI 07 Carotid Endarterectomy Volume	IQ07
IQI 08 Esophageal Resection Mortality Rate	IQ08
IQI 09 Pancreatic Resection Mortality Rate	IQ09
IQI 9A Pancreatic Resection Mortality Rate – Stratum A	IQ09A
IQI 9B Pancreatic Resection Mortality Rate – Stratum B	IQ09B
IQI 11 Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate	IQ11
IQI 11A Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate – Stratum A	IQ11A
IQI 11B Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate – Stratum B	IQ11B
IQI 11C Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate – Stratum C	IQ11C
IQI 11D Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate – Stratum D	IQ11D
IQI 12 Coronary Artery Bypass Graft (CABG) Mortality Rate	IQ12
IQI 13 Craniotomy Mortality Rate	IQ13
IQI 14 Hip Replacement Mortality Rate	IQ14
IQI 15 Acute Myocardial Infarction (AMI) Mortality Rate	IQ15
IQI 16 Heart Failure Mortality Rate	IQ16
IQI 17 Acute Stroke Mortality Rate	IQ17
IQI 17A Acute Stroke Mortality Rate – Stratum A	IQ17A
IQI 17B Acute Stroke Mortality Rate – Stratum B	IQ17B
IQI 17C Acute Stroke Mortality Rate – Stratum C	IQ17C
IQI 18 Gastrointestinal Hemorrhage Mortality Rate	IQ18
IQI 19 Hip Fracture Mortality Rate	IQ19
IQI 20 Pneumonia Mortality Rate	IQ20
IQI 21 Cesarean Delivery Rate, Uncomplicated	IQ21
IQI 22 Vaginal Birth After Cesarean (VBAC) Delivery Rate, Uncomplicated	IQ22
IQI 23 Laparoscopic Cholecystectomy Rate	IQ23
IQI 24 Incidental Appendectomy in the Elderly Rate	IQ24
IQI 25 Bilateral Cardiac Catheterization Rate	IQ25
IQI 30 Percutaneous Coronary Intervention (PCI) Mortality Rate	IQ30
IQI 31 Carotid Endarterectomy Mortality Rate	IQ31
IQI 32 Acute Myocardial Infarction (AMI) Mortality Rate, Without Transfer Cases	IQ32
IQI 33 Primary Cesarean Delivery Rate, Uncomplicated	IQ33
IQI 34 Vaginal Birth After Cesarean (VBAC) Rate, All	IQ34
AREA-LEVEL INDICATORS	
IQI 26 Coronary Artery Bypass Graft (CABG) Rate	IQ26
IQI 27 Percutaneous Coronary Intervention (PCI) Rate	IQ27
IQI 28 Hysterectomy Rate	IQ28
IQI 29 Laminectomy or Spinal Fusion Rate	IQ29

IQI: Inpatient Quality Indicator

The SAS programs in the IQI module employ a consistent naming convention for the variables used to store the different indicator results. The first character of the variable name (prefix) indicates what type of result the variable stores (see Table 3). The second character is either "A" if the indicator is area level or "P" if the indicator is provider level. The remaining characters are an abbreviation that identifies the indicator by module and number. The first two characters of the abbreviation are "IQ" to indicate the result is associated with the IQI module. The last characters in the abbreviation are numbers and letters matching the indicator number and stratum (if applicable) within the module. Table 4 lists the abbreviations used to name the ISAS QI variables. Examples of this naming convention applied to the IQI module are provided in Table 3. As indicated in Table 3, the smoothed rate and signal posterior standard deviation are not reported for stratified indicators; i.e., those indicators ending in "A," "B," etc. In the IQI module, this impacts the following indicators: IQI 9A, IQI 9B, IQI 11A, IQI 11B, IQI 11C, IQI 11D, IQI 17A, IQI 17B, and IQI 17C.

Table 3. Prefixes for the Variables Used To Store IQI Results

PREFIX	TYPE OF RESULT	EXAMPLE: PROVIDER- LEVEL INDICATOR (IQI 08)	EXAMPLE: AREA-LEVEL INDICATOR (IQI 26)
T	Inpatient numerator (top)	TPIQ08	TAIQ26
P	Population denominator (pop)	PPIQ08	PAIQ26
Q	Present on admission flag	QPIQ08	N/A
O	Observed rate	OPIQ08	OAIQ26
E	Expected rate	EPIQ08	EAIQ26
R	Risk-adjusted rate	RPIQ08	RAIQ26
L	Lower limit of confidence interval for risk-adjusted rate	LPIQ08	LAIQ26
U	Upper limit of confidence interval for risk-adjusted rate	UPIQ08	UAIQ26
S	Smoothed rate (not reported for strata)	SPIQ08	SAIQ26
X	Signal posterior standard deviation (not reported for strata)	XPIQ08	XAIQ26

Note: Some types of results will not be applicable to certain indicators.
IQI: Inpatient Quality Indicator

The ISAS QI programs load data from auxiliary files. These auxiliary files are in ASCII text or comma-separated value (CSV) format. There is no need to convert these files to SAS format for use with the software.

Table 4 lists the SAS programs included in the IQI module and which auxiliary files (if any) are required by those program files. The POP95T14.TXT file is available on the AHRQ QIs Web site as a separate download. All of the other auxiliary files are included in the IQI module download package.

Table 4. Files Included in the IQI Module

SAS PROGRAM FILE NAME	AUXILIARY FILES REQUIRED BY SAS PROGRAM FILE
CONTROL_IQI.SAS	
IQFMTS.SAS	
IQSAS1.SAS	
IQSASP2.SAS	
IQSASP3.SAS QI50_MAKEVARS_IQI	MSXIQP50.TXT MSXIQP50_NOPOA.TXT QI50_IQI_nn_POA.CSV QI50_IQI_nn_NOPOA.CSV
IQSASA2.SAS	POP95T14.TXT
IQSASA3.SAS	MSXIQA50.TXT COVIQA50.TXT POP95T14.TXT
IQI_COMPOSITE.SAS	MSXIQC50.TXT MXIQC50.TXT

3.2   Pediatric Quality Indicators (PDIs) Quick Reference

Figure 6 shows the processing steps for the provider-level indicators in the PDI module, and Figure 7 shows the processing steps for the area-level indicators in the PDI module. Table 5 lists the indicators calculated in the PDI module, arranged by provider level or area level. The module calculates 12 provider-level indicators and 5 area-level indicators that focus on the pediatric population. In addition, the module calculates three Neonatal Quality Indicators (NQI) focused on neonatal care.

Two indicators that are conceptually related to other modules, PQI 09 Low Birth Weight Rate and PSI 17 Birth Trauma Rate – Injury to Neonate, are calculated within the PDI module because they are based on the number of births. In addition, the two standalone modules introduced with SAS QI v5.0—PQI 09 Standalone Module and PSI 17 Standalone Module— calculate these PQI 09 and PSI 17 indicators without the requirement to run the entire PDI module. These two standalone modules are available as separate downloads from the AHRQ QIs Web site. The standalone modules include the same processing steps as the area-level PDI module and the provider-level PDI module, respectively, for PQI 09 and PSI 17.

Figure 6. Processing Steps for the Provider-Level Indicators in the PDI Module
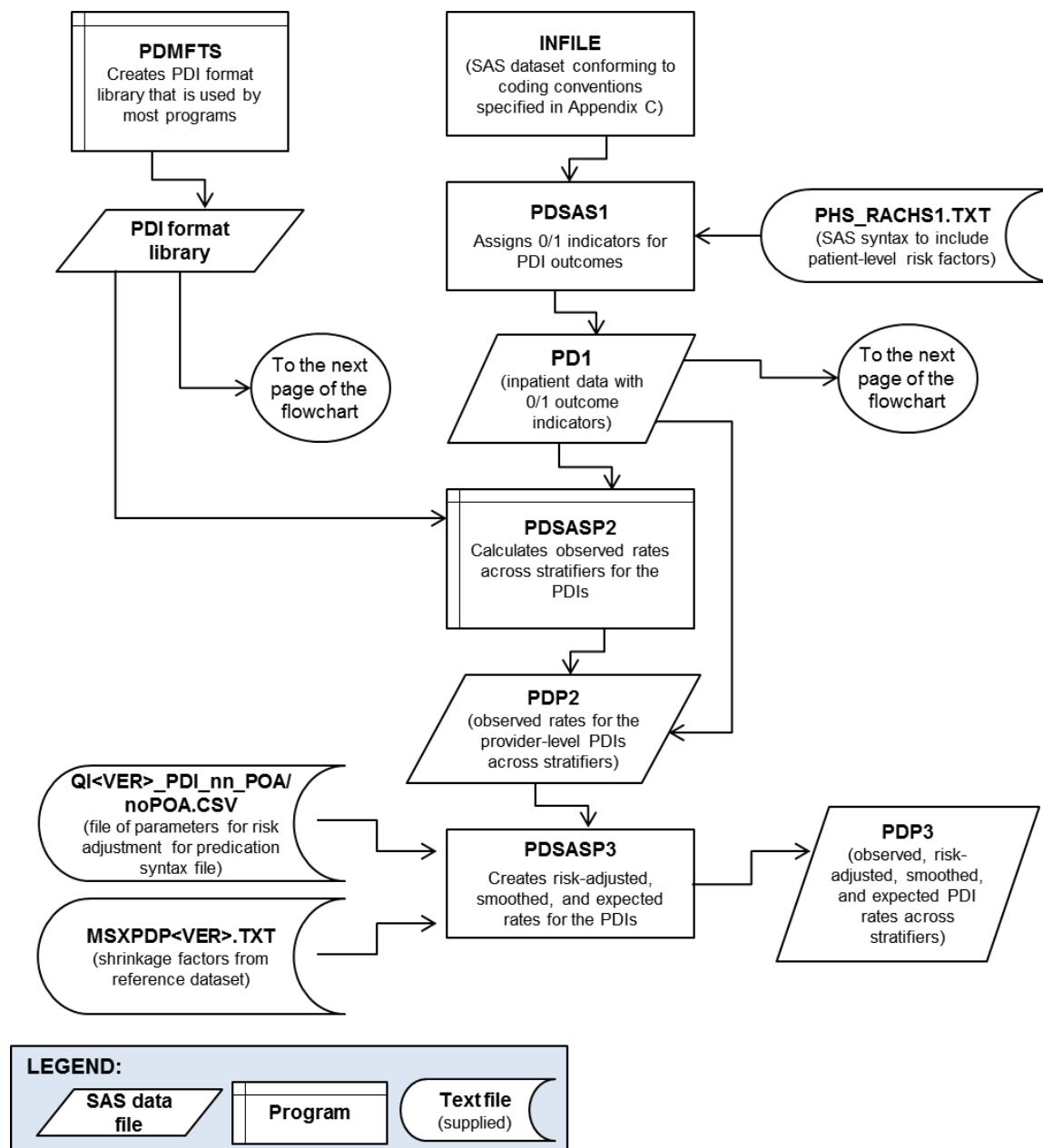
Note: Each of the SAS programs in this figure incorporates the CONTROL_PDI.SAS program, which contains code the user **must** modify in order to run the PDI software. The modifications include, for example, specifying the name and location of the input, population, and output datasets. PDI: Pediatric Quality Indicator

Figure 7. Processing Steps for the Area-Level Indicators in the PDI Module
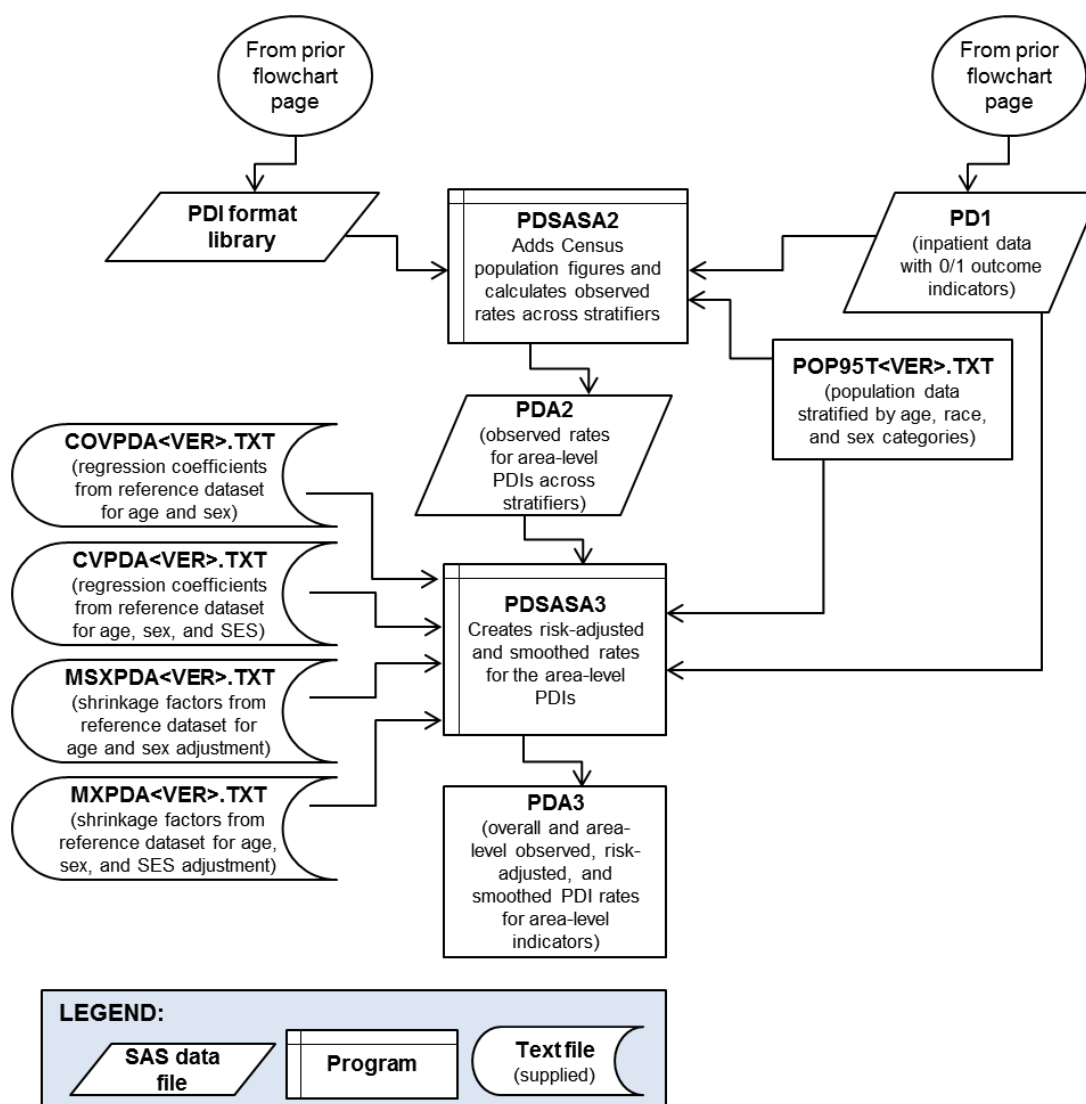
Note: Each of the SAS programs in this figure incorporates the CONTROL_PDI.SAS program, which contains code the user **must** modify in order to run the PDI software. The modifications include, for example, specifying the name and location of the input, population, and output datasets. PDI: Pediatric Quality Indicator; SES: socioeconomic status

Table 5. Indicators Computed in the PDI Module and Variable Abbreviation

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
PROVIDER-LEVEL INDICATORS	
NQI 01 Neonatal Iatrogenic Pneumothorax Rate	NQ01
NQI 02 Neonatal Mortality Rate	NQ02
NQI 03 Neonatal Blood Stream Infection Rate	NQ03
PDI 01 Accidental Puncture or Laceration Rate	PD01
PDI 02 Pressure Ulcer Rate	PD02
PDI 03 Retained Surgical Item or Unretrieved Device Fragment Count	PD03

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
PDI 05 Iatrogenic Pneumothorax Rate	PD05
PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate	PD06
PDI 07 RACHS-1 Pediatric Heart Surgery Volume	PD07
PDI 08 Perioperative Hemorrhage or Hematoma Rate	PD08
PDI 09 Postoperative Respiratory Failure Rate	PD09
PDI 10 Postoperative Sepsis Rate	PD10
PDI 11 Postoperative Wound Dehiscence Rate	PD11
PDI 12 Central Venous Catheter-Related Blood Stream Infection Rate	PD12
PDI 13 Transfusion Reaction Count	PD13
PSI 17 Birth Trauma Rate – Injury to Neonate	PS17
AREA-LEVEL INDICATORS	
PDI 14 Asthma Admission Rate	PD14
PDI 15 Diabetes Short-Term Complications Admission Rate	PD15
PDI 16 Gastroenteritis Admission Rate	PD16
PDI 17 Perforated Appendix Admission Rate[*]	PD17
PDI 18 Urinary Tract Infection Admission Rate	PD18
PDI 90 Pediatric Quality Overall Composite	PD90
PDI 91 Pediatric Quality Acute Composite	PD91
PDI 92 Pediatric Quality Chronic Composite	PD92
PQI 09 Low Birth Weight Rate	PQ09

[*]The denominator for PDI 17 includes all hospital admissions for appendicitis in the area.
NQI: Neonatal Quality Indicator; PDI: Pediatric Quality Indicator

The SAS programs in the PDI module employ a consistent naming convention for the variables used to store the different indicator results. The first character of the variable name (prefix) indicates what type of result the variable stores (see Table 6). The second character is either "A" if the indicator is area level or "P" if the indicator is provider level. The remaining characters are an abbreviation that identifies the indicator by module and number. The abbreviation is based on the conceptual module to which the indicator belongs: "PD" for the indicators labeled as PDIs, "NQ" for the indicators labeled as NQIs, "PQ" for the indicators labeled as PQIs, and "PS" for the indicators labeled as PSIs. The last characters in the abbreviation are numbers matching the indicator number. Table 5 lists the abbreviations used to name the PDI SAS variables. Examples of this naming convention applied to the PDI module are provided in Table 6.

Table 6. Prefixes for the Variables Used To Store PDI Results

PREFIX	TYPE OF RESULT	EXAMPLE: PROVIDER- LEVEL INDICATOR (PDI 08)	EXAMPLE: AREA-LEVEL INDICATOR (PDI 14)
T	Inpatient numerator (top)	TPPD08	TAPD14
P	Population denominator (pop)	PPPD08	PAPD14
Q	Present on admission flag	QPPD08	N/A
O	Observed rate	OPPD08	OAPD14
E	Expected rate	EPPD08	EAPD14
R	Risk-adjusted rate	RPPD08	RAPD14
L	Lower limit of confidence interval for risk-adjusted rate	LPPD08	LAPD14
U	Upper limit of confidence interval for risk-adjusted rate	UPPD08	UAPD14
S	Smoothed rate	SPPD08	SAPD14
X	Signal posterior standard deviation	XPPD08	XAPD14

Note: Some types of results will not be applicable to certain indicators.
PDI: Pediatric Quality Indicator

The PDI SAS programs load data from auxiliary files. These auxiliary files are in ASCII text or comma-separated value (CSV) format. There is no need to convert these files to SAS format for use with the software. Table 7 lists the SAS programs included in the PDI module and which auxiliary files (if any) are required by those program files. The POP95T14.TXT file is available on the AHRQ QIs Web site as a separate download. All of the other auxiliary files are included in the PDI module download package.

Table 7. Files Included in the PDI Module

SAS PROGRAM FILE NAME	AUXILIARY FILES REQUIRED BY SAS PROGRAM FILE
CONTROL_PDI.SAS	
PDFMTS.SAS	
PDSAS1.SAS	PHS_RACHS1.TXT
PDSASA2.SAS	POP95T14.TXT
PDSASA3.SAS QI50_MAKEVARS_PDI	MXPDA50A.TXT MSXPDA50.TXT COVPDA50.TXT CVPDA50A.TXT POP95T14.TXT
PDSASG2.SAS	
PDSASP2.SAS	
PDSASP3.SAS	MSXPDP50.TXT MSXPDP50_NOPOA.TXT QI50_PDI_nn_POA.CSV QI50_PDI_nn_NOPOA.CSV
PDI_COMPOSITE.SAS	MSXPDC50.TXT MXPDC50.TXT

3.3   Prevention Quality Indicators (PQIs) Quick Reference

Figure 8 shows the processing steps for the area-level indicators in the PQI module. For certain indicators, the PQI module can calculate admission rates using a denominator based on the prevalence of the condition at the State level. Figure 9 shows the processing steps for these condition specific indicators in the PQI module. Table 8 lists the indicators calculated in the PQI module. All indicators calculated by the PQI module are area level.

PQI 09 is a pediatric indicator that can be calculated using either the PDI module or the PQI 09 Standalone Module. The PQI 09 Standalone Module is available as a separate download from the AHRQ QIs Web site.

Figure 8. Processing Steps for the Area-Level Indicators in the PQI Module
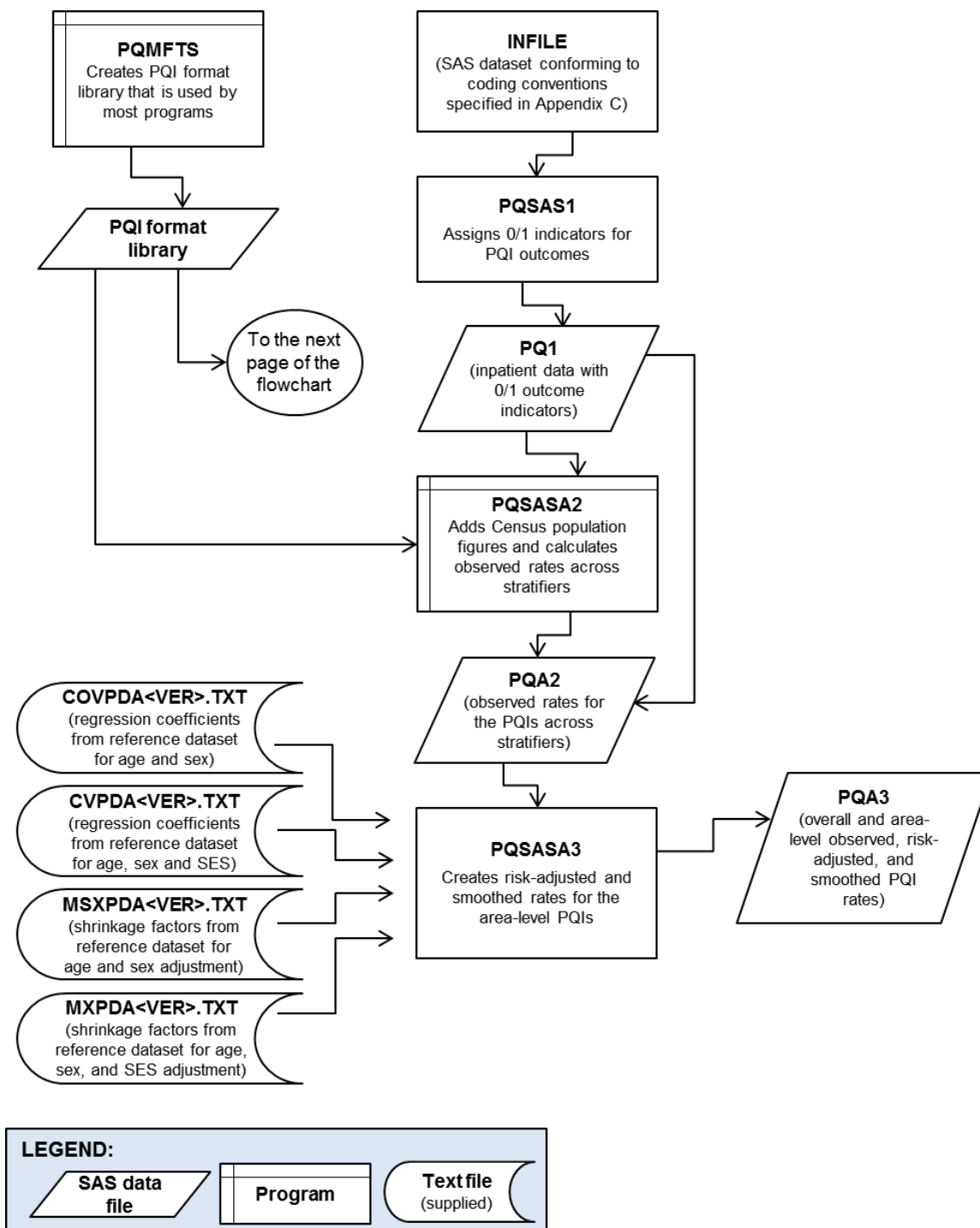
Note: Each of the SAS programs in this figure incorporates the CONTROL_PQI.SAS program, which contains code the user **must** modify in order to run the PQI software. The modifications include, for example, specifying the name and location of the input, population, and output datasets. PQI: Prevention Quality Indicator; SES: socioeconomic status

Figure 9. Processing Steps for the Condition-Specific Indicators in the PQI Module
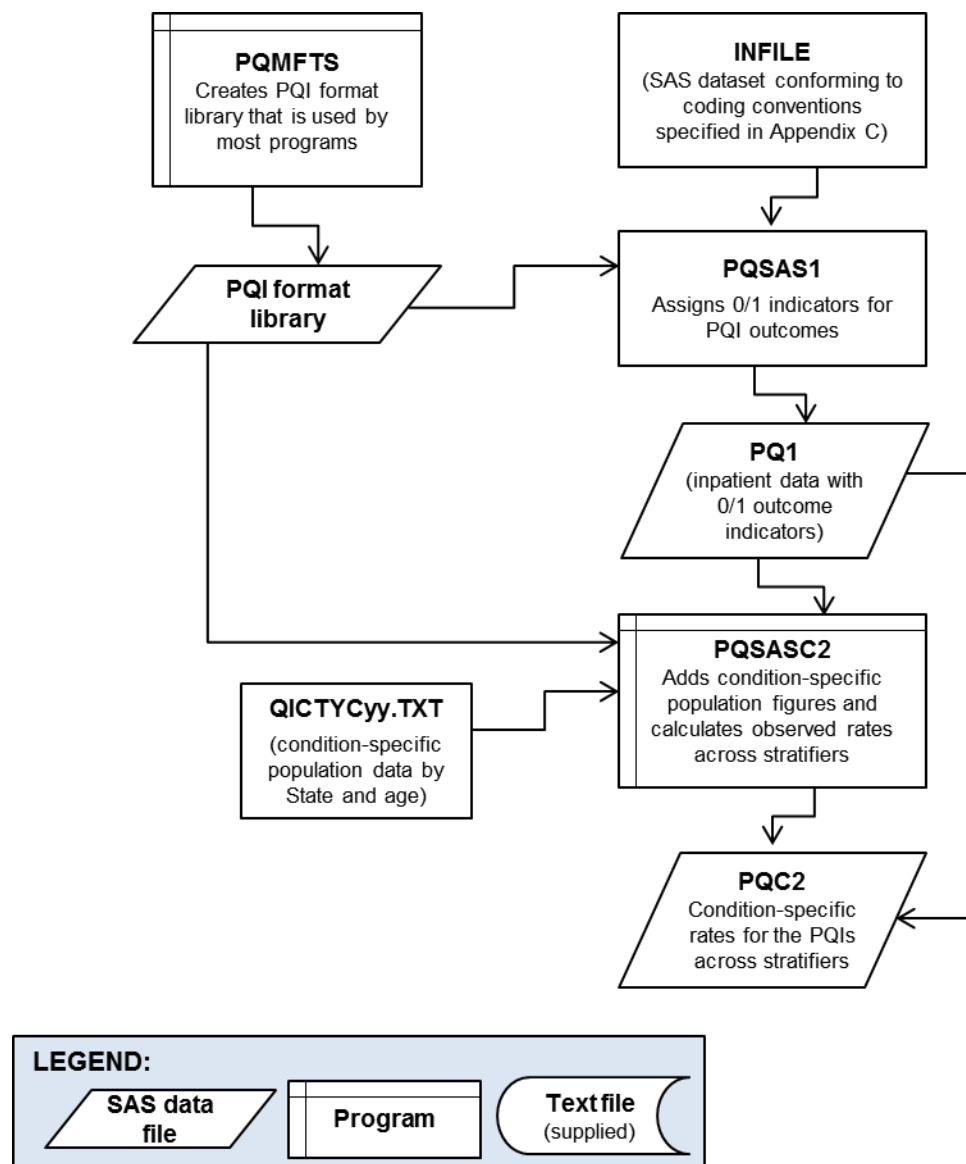
Note: Each of the SAS programs in this figure incorporates the CONTROL_PQI.SAS program, which contains code the user **must** modify in order to run the PQI software. The modifications include, for example, specifying the name and location of the input, population, and output datasets.
PQI: Prevention Quality Indicator

Table 8. Indicators Computed in the PQI Module and Variable Abbreviation

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
PQI 01 Diabetes Short-Term Complications Admission Rate	PQ01
PQI 02 Perforated Appendix Admission Rate*	PQ02
PQI 03 Diabetes Long-Term Complications Admission Rate	PQ03
PQI 05 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate	PQ05
PQI 07 Hypertension Admission Rate	PQ07
PQI 08 Heart Failure Admission Rate	PQ08
PQI 10 Dehydration Admission Rate	PQ10
PQI 11 Bacterial Pneumonia Admission Rate	PQ11
PQI 12 Urinary Tract Infection Admission Rate	PQ12
PQI 13 Angina Without Procedure Admission Rate	PQ13
PQI 14 Uncontrolled Diabetes Admission Rate	PQ14
PQI 15 Asthma in Younger Adults Admission Rate	PQ15
PQI 16 Lower-Extremity Amputation among Patients with Diabetes Rate	PQ16
PQI 90 Prevention Quality Overall Composite	PQ90
PQI 91 Prevention Quality Acute Composite	PQ91
PQI 92 Prevention Quality Chronic Composite	PQ92

*The denominator for PQI 02 includes all hospital admissions for appendicitis in the area.
Note: PQI 09 is calculated in the PDI module.
PQI: Prevention Quality Indicator

The SAS programs in the PQI module employ a consistent naming convention for the variables used to store the different indicator results. The first character of the variable name (prefix) indicates what type of result the variable stores (see Table 9). The second character is "A" to note that the indicator is area level (all indicators calculated by the PQI module are area level). The remaining characters are an abbreviation that identifies the indicator by module and number. The first two characters of the abbreviation are "PQ" to indicate that the result is associated with the PQI module. The last characters in the abbreviation are numbers matching the indicator number within the module. Table 8 lists the abbreviations used to name the PSAS QI variables. Examples of this naming convention applied to the PQI module are provided in Table 9.

Table 9. Prefixes for the Variables Used To Store PQI Results

PREFIX	TYPE OF RESULT	EXAMPLE (PQI 01)
T	Inpatient numerator (top)	TAPQ01
P	Population denominator (pop)	PAPQ01
O	Observed rate	OAPQ01
E	Expected rate	EAPQ01
R	Risk-adjusted rate	RAPQ01
L	Lower limit of confidence interval of risk-adjusted rate	LAPQ01
U	Upper limit of confidence interval of risk-adjusted rate	UAPQ01
S	Smoothed rate	SAPQ01
X	Signal posterior standard deviation	XAPQ01
C	Condition-specific rate	CAPQ01

Note: Some types of results will not be applicable to certain indicators.
PQI: Prevention Quality Indicator

The SAS QI programs load data from auxiliary files. These auxiliary files are in ASCII text format. There is no need to convert these files to SAS format for use with the software. Table 10 lists the SAS programs included in the PQI module and which auxiliary files (if any) are required by those program files. The POP95T14.TXT file is available on the AHRQ QIs Web site as a separate download. All of the other auxiliary files are included in the PQI module download package.

Table 10. Files Included in the PQI Module

SAS PROGRAM FILE NAME	AUXILIARY FILES REQUIRED BY SAS PROGRAM FILE
CONTROL_PQI.SAS	
PQFMTS.SAS	
PQSAS1.SAS	
PQSASA2.SAS	POP95T14.TXT
PQSASA3.SAS	COVPQA50.TX MSXPQA50.TXT CVPQA50A.TXT MXPQA50A.TXT POP95T14.TXT
PQSASC2.SAS	QICTYC14.TXT

3.4 Patient Safety Indicators (PSIs) Quick Reference

Figure 10 shows the processing steps for the provider-level indicators in the PSI module, and Figure 11 shows the processing steps for the area-level indicators in the PSI module. Table 11 lists the indicators calculated in the PSI module arranged by provider level or area level.

PSI 17 is a pediatric indicator that can be calculated using either the PDI module or the PSI 17 Standalone Module. The PSI 17 Standalone Module is available as a separate download from the AHRQ QIs Web site.

Figure 10. Processing Steps for Provider-Level Indicators in the PSI Module
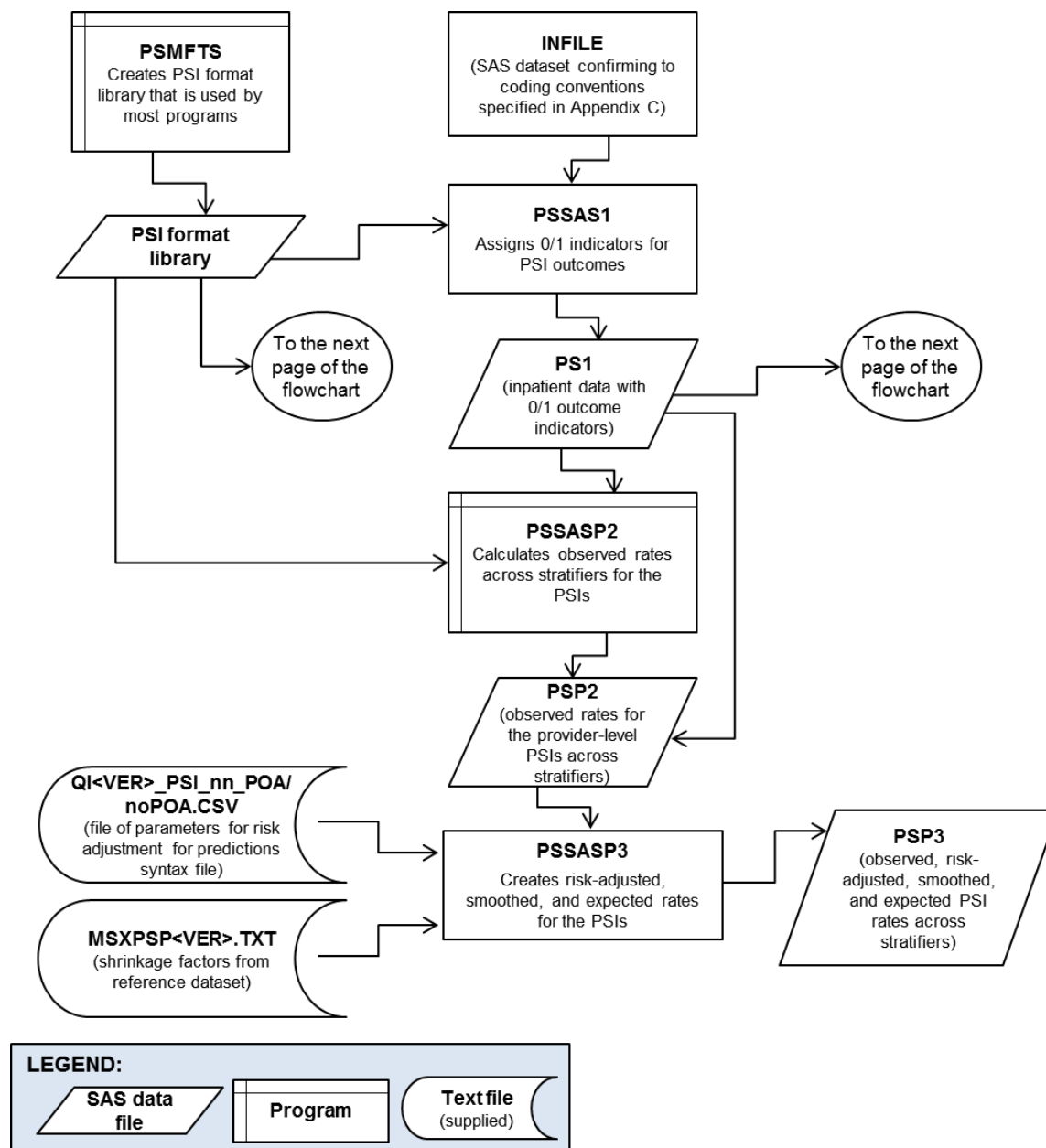
Note: Each of the SAS programs in this figure incorporates the CONTROL_PSI.SAS program, which contains code the user **must** modify in order to run the PSI software. The modifications include such items as specifying the name and location of the input, population, and output datasets.
PSI: Patient Safety Indicator

Figure 11. Processing Steps for the Area-Level Indicators in the PSI Module
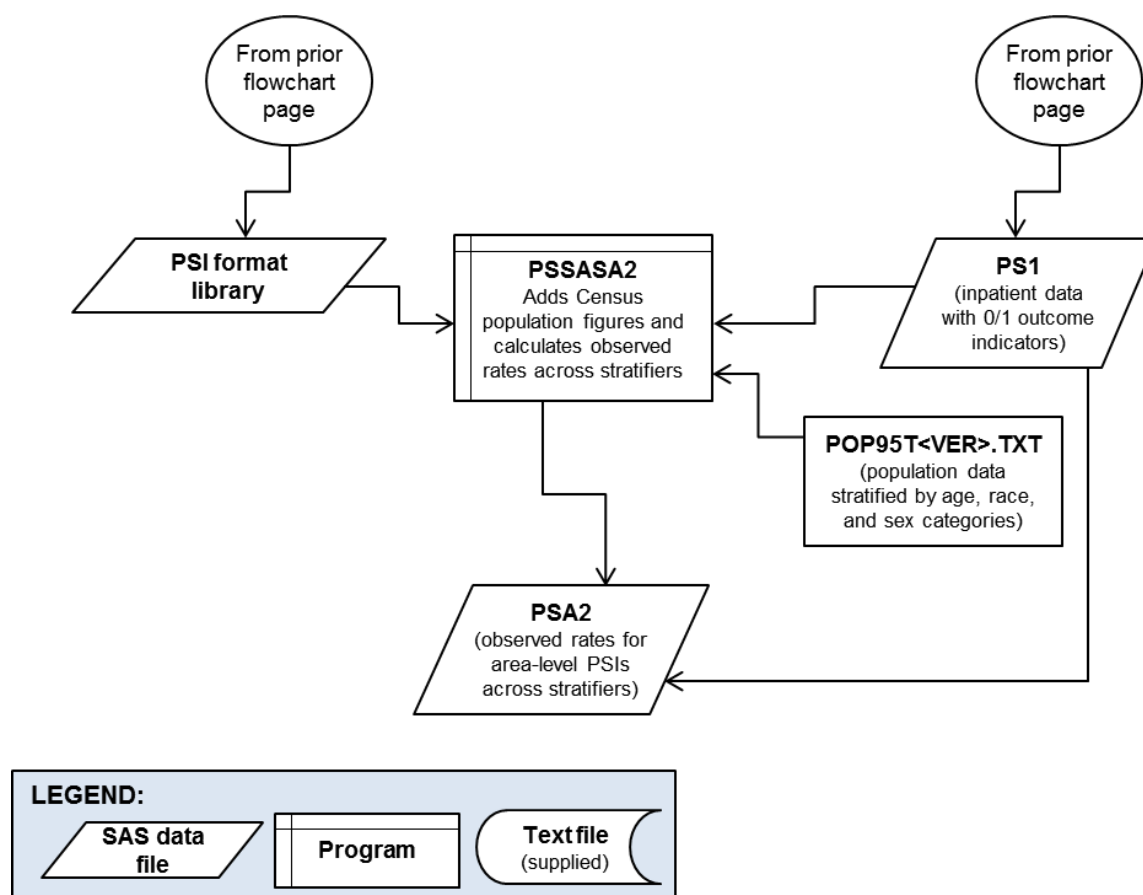
Note: Each of the SAS programs in this figure incorporates the CONTROL_PSI.SAS program, which contains code the user **must** modify in order to run the PSI software. The modifications include such items as specifying the name and location of the input, population, and output datasets.
PSI: Patient Safety Indicator

Table 11. Indicators Computed in the PSI Module and Variable Abbreviation

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
PROVIDER-LEVEL INDICATORS	
PSI 02 Death Rate in Low-Mortality Diagnosis Related Groups (DRGs)	PS02
PSI 03 Pressure Ulcer Rate	PS03
PSI 04 Death Rate among Surgical Inpatients with Serious Treatable Complications	PS04
PSI 4A Death Rate among Surgical Inpatients with Serious Treatable Complications – Stratum A	PS04A
PSI 4B Death Rate among Surgical Inpatients with Serious Treatable Complications – Stratum B	PS04B
PSI 4C Death Rate among Surgical Inpatients with Serious Treatable Complications – Stratum C	PS04C
PSI 4D Death Rate among Surgical Inpatients with Serious Treatable	PS04D

INDICATOR NAME	ABBREVIATION USED IN SAS VARIABLE NAMES
Complications – Stratum D	
PSI 4E Death Rate among Surgical Inpatients with Serious Treatable Complications – Stratum E	PS04E
PSI 05 Retained Surgical Item or Unretrieved Device Fragment Count	PS05
PSI 06 Iatrogenic Pneumothorax Rate	PS06
PSI 07 Central Venous Catheter-Related Blood Stream Infection Rate	PS07
PSI 08 Postoperative Hip Fracture Rate	PS08
PSI 09 Perioperative Hemorrhage or Hematoma Rate	PS09
PSI 10 Postoperative Physiologic and Metabolic Derangement Rate	PS10
PSI 11 Postoperative Respiratory Failure Rate	PS11
PSI 12 Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate	PS12
PSI 13 Postoperative Sepsis Rate	PS13
PSI 14 Postoperative Wound Dehiscence Rate	PS14
PSI 15 Accidental Puncture or Laceration Rate	PS15
PSI 16 Transfusion Reaction Count	PS16
PSI 18 Obstetric Trauma Rate – Vaginal Delivery With Instrument	PS18
PSI 19 Obstetric Trauma Rate – Vaginal Delivery Without Instrument	PS19
AREA-LEVEL INDICATORS	
PSI 21 Retained Surgical Item or Unretrieved Device Fragment Rate	PS21
PSI 22 Iatrogenic Pneumothorax Rate	PS22
PSI 23 Central Venous Catheter-Related Blood Stream Infection Rate	PS23
PSI 24 Postoperative Wound Dehiscence Rate	PS24
PSI 25 Accidental Puncture or Laceration Rate	PS25
PSI 26 Transfusion Reaction Rate	PS26
PSI 27 Perioperative Hemorrhage or Hematoma Rate	PS27

Note: PSI 17 is calculated in the PDI module.
PSI: Patient Safety Indicator

The SAS programs in the PSI module employ a consistent naming convention for the variables used to store the different indicator results. The first character of the variable name (prefix) indicates what type of result the variable stores (see Table 12). The second character is either "A" if the indicator is area level or "P" if the indicator is provider level. The remaining characters are an abbreviation that identifies the indicator by module and number. The first two characters of the abbreviation are "PS" to indicate that the result is associated with the PSI module. The last characters in the abbreviation are numbers and letters matching the indicator number and stratum (if applicable) within the module. Table 11 lists the abbreviations used to name the PSI SAS variables. Examples of this naming convention applied to the PSI module are provided in Table 12. As indicated in Table 12, the smoothed rate and the signal posterior standard deviation are not reported for stratified indicators; i.e., those indicators ending in "A," "B," etc. In the PSI module, this impacts PSI 4A, PSI 4B, PSI 4C, PSI 4D, and PSI 4E.

Table 12. Prefixes for the Variables Used to Store PSI Results

PREFIX	TYPE OF RESULT	EXAMPLE: PROVIDER-LEVEL INDICATOR (PSI 08)	EXAMPLE: AREA-LEVEL INDICATOR (PSI 23)
T	Inpatient numerator (top)	TPPS08	TAPS23
P	Population denominator (pop)	PPPS08	PAPS23
O	Observed rate	OPPS08	OAPS23
Q	Present on admission flag	QPPS08	N/A
E	Expected rate	EPPS08	N/A
R	Risk-adjusted rate	RPPS08	N/A
L	Lower limit of confidence interval of risk-adjusted rate	LPPS08	N/A
U	Upper limit of confidence interval of risk-adjusted rate	UPPS08	N/A
S	Smoothed rate (not reported for strata)	SPPS08	N/A
X	Signal posterior standard deviation (not reported for strata)	XPPS08	N/A

Note: Some types of results will not be applicable to certain indicators.
PSI: Patient Safety Indicator

The PSI SAS programs load data from auxiliary files. These auxiliary files are in ASCII text or comma-separated value (CSV) format. There is no need to convert these files to SAS format for use with the software. Table 13 lists the SAS programs included in the PSI module and which auxiliary files (if any) are required by those program files. The POP95T13.TXT file is available on the AHRQ QIs Web site as a separate download. All of the other auxiliary files are included in the PSI module download package.

Table 13. Files Included in the PSI Module

SAS PROGRAM FILE NAME	AUXILIARY FILES REQUIRED BY SAS PROGRAM FILE
CONTROL_PSI.SAS	
PSFMTS.SAS	CMBFQI32.TXT CMBFQI37.TXT
PSSAS1.SAS	CMBAQI32.TXT CMBAQI37.TXT
PSSASA2.SAS	POP95T14.TXT
PSSASP2.SAS	
PSSASP3.SAS QI50_MAKEVARS_PSI	MSXPSP50.TXT MSXPSP50_NOPOA.TXT QI50_PSI_nn_POA.CSV QI50_PSI_nn_NOPOA.CSV
PSI_COMPOSITE.SAS	MSXPSC50A.TXT MXPSC50A.TXT

4.0 Background

Each module of the AHRQ QIs reflects quality-of-care measures to highlight potential quality concerns, identify areas that need further study and investigation, and track changes over time. The data required for measuring these indicators come from hospital discharge abstracts or billing claims (administrative data), which are readily available within hospitals or from many State data organizations. The AHRQ QI software is intended to be used with data that cover an entire patient population; e.g., all discharges from a hospital in a year) or that were sampled from a patient population using simple random sampling. Beginning with SAS QI® Version 4.1, the software does not support weighted QI estimates or standard errors for weighted estimates. Thus, analyses using data obtained from a complex sampling design will not produce accurate estimates for the population from which the data were sampled. The residential population data for the area-level utilization indicators are from the U.S. Census Bureau (see 2014 Population File for Use with AHRQ Quality Indicators™ http://www.qualityindicators.ahrq.gov/Downloads/Software/SAS/V45/AHRQ_QI_Population_File_V4.5.pdf).

The software generates observed, expected, risk-adjusted, and smoothed rates across the modules for most indicators. Observed rates are the raw rates, which are the count of discharge records including the health outcome of interest divided by the count of discharge records in the patient population at risk. Expected and risk-adjusted rates both acknowledge that individual providers (or areas of the country) are unique and differ in two important ways from the representative profile observed in the reference population. First, there is heterogeneity in the quality of care that is provided: Some providers and areas provide exemplary care, while others provide substandard care. This is an important dimension of difference. Second, most individual providers serve patients with a distribution of covariates (demographics and comorbidities) that differs from the reference population: Some providers serve populations who are at higher risk for adverse events, while some serve populations who are at lower risk. This dimension of difference makes it difficult to perform meaningful comparisons of observed rates. The expected and risk-adjusted rates each peg one of these two dimensions (quality of care or patient mix) to that observed in the reference population and then comment on the second dimension as observed in the local data.

The expected rate answers the question, "What rate of adverse events would we expect to see if this provider (or area) provided the average level of care observed in the reference population but provided it to patients with the locally observed distribution of characteristics?"; i.e., average performance from the reference population of the universe of patients applied to locally observed mix of patients with their local risk profiles. When the observed rate is smaller than the expected rate (or the observed/expected ratio is <1), then there is reason to think that the hospital (or area) is performing better than average on this indicator.

The risk-adjusted rate answers the converse question: "What rate of adverse events would we see in this provider (or area) if they provided the locally observed quality of care to patients whose

distribution of characteristics matched those in the reference population?"; i.e., locally observed performance on a representative mix of patients from the reference population. Risk-adjusted rates are useful in comparisons between providers or areas. They are evaluated on an identical mix of patients, so calculating them is an attempt to remove the confounding influence of patient mix (different profiles of risk that are not related to care) from the comparison.

The smoothed rate is a weighted average of the reference population rate and the locally observed (provider or area) rate. If the data from the individual provider or area include many observations and provide a numerically stable estimate of the rate, then the smoothed rate will be very close to the risk-adjusted rate and not heavily influenced by the reference population rate. Conversely, the smoothed rate will be closer to the reference population rate if the provider or area rate is based on a small number of observations that may not be numerically stable, especially from year to year.

The software also calculates 95 percent intervals for some of the rates (confidence intervals in the case of risk-adjusted rates, probability intervals for composite and smoothed rates). These intervals can be used to test whether the computed rate is statistically different from a reference value. If the reference value is greater than the upper bound of the interval, then the computed rate is statistically lower than the reference value. If the reference value is less than the lower bound of the interval, then the computed value is statistically higher than the reference value. If the reference value falls between the lower and upper bounds, then there is no statistical difference between the computed rate and the reference value. For a more thorough explanation of risk-adjusted and smoothed rates, please see the technical documentation on the AHRQ QIs Web site.

4.1   Inpatient Quality Indicators (IQIs) Background

The IQI module contains 32 indicators (plus 2 composite indicators) that reflect the quality of care inside hospitals. The six volume measures are intended to be paired with the corresponding mortality indicators. The indicators include three groups of measures based on hospital stays.

1. There are six volume indicators for inpatient procedures for which there is evidence that a higher volume of procedures is associated with lower mortality. A nontrivial number of these procedures are performed by institutions that do not meet recommended volume thresholds. The volume indicators are measured as counts of admissions in which particular procedures were performed.

2. There are 15 inpatient mortality indicators for medical conditions and surgical procedures that have been shown to have mortality rates that vary substantially across institutions and for which evidence suggests that high mortality may be associated with deficiencies in the quality of care. These indicators are measured as rates—the number of deaths divided by the number of admissions for the procedure or condition. Eight of these mortality indicators are for procedures, six of which are also measured by a volume indicator. The other seven mortality indicators are associated with medical conditions.

3. There are 11 utilization indicators for procedures for which there are questions of overuse, underuse, or misuse. The usage of these procedures varies significantly across hospitals and areas, and high or low rates by themselves do not represent poor quality of care; rather, the information is intended to inform consumers about local practice patterns. Seven of these utilization indicators are rates based on the hospitalized population. Four other utilization indicators are rates based on an area's residential population. Two of these area-level utilization indicators, IQI 26 Coronary Artery Bypass Graft (CABG) Rate and IQI 27 Percutaneous Coronary Intervention (PCI) Rate, have counterparts in the set of volume indicators.

4. There are five indicators that have stratified results reported in SAS QI v5.0. Overall results for these measures are reported as well as results for those discharges with specific medical conditions. The results for IQI 02 Pancreatic Resection Volume and IQI 09 Pancreatic Resection Mortality Rate are reported separately for those patients that have pancreatic cancer and those that do not. The results for IQI 04 Abdominal Aortic Aneurysm (AAA) Repair Volume and IQI 11 Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate are reported separately for patients depending on whether the AAA was ruptured or unruptured and whether the repair was open or endovascular. The results for IQI 17 Acute Stroke Mortality Rate are reported separately for those patients with subarachnoid stroke, those with hemorrhagic stroke, and those with ischemic stroke. SAS QI v5.0 does not report smoothed rates for the strata; all other results reported for the overall indicator are also reported for the strata.

5. The software does not report expected rates, risk-adjusted rates, and smoothed rates for the following indicators: IQI 21 Cesarean Delivery Rate, Uncomplicated; IQI 22 Vaginal Birth After Cesarean (VBAC) Delivery Rate, Uncomplicated; IQI 23 Laparoscopic Cholecystectomy Rate; IQI 24 Incidental Appendectomy in the Elderly Rate; IQI 25 Bilateral Cardiac Catheterization Rate; IQI 33 Primary Cesarean Delivery Rate, Uncomplicated; and IQI 34 Vaginal Birth After Cesarean (VBAC) Rate, All. These measures are not risk adjusted, so only the numerators, denominators, and observed rates are reported.

4.2   Pediatric Quality Indicators (PDIs) Background

The PDI module contains 15 indicators that reflect the quality of care inside hospitals and eight indicators that reflect the quality of care outside hospitals. These indicators serve as flags for potential quality problems rather than definitive measures of quality of care. The indicators include two groups of measures based on hospital stays.

1. There are 15 provider-level PDIs for medical conditions and procedures that have been shown to have complication/adverse event rates that vary substantially across institutions and for which evidence suggests that high complication/adverse event rates may be associated with deficiencies in the quality of care. There are also three indicators for neonates. These indicators are measured as rates—outcome of interest/adverse events divided by the population at risk for the procedure or condition. The adverse event–

related provider-level indicators usually include only those cases where a secondary diagnosis code flags a potentially preventable complication. A few indicators are based on procedure codes that imply a potentially preventable adverse event. Four of the adverse event–related indicators are for surgical discharges, and seven are for either medical or surgical discharges. Four of the provider-level PDIs (PDI 02 Pressure Ulcer Rate, PDI 08 Perioperative Hemorrhage or Hematoma Rate, PDI 09 Postoperative Respiratory Failure Rate, and PDI 11 Postoperative Wound Dehiscence Rate) incorporate information about when procedures were performed (relative to the admission date), if this information is available. Note, however, that if the day-of-procedure information is missing, the computed rates for these indicators will be slightly lower than if the information was available. Admission type and point of origin are used by two of the PDIs (PDI 08 and PDI 09) to identify elective surgeries.

2. There are eight area-level PDIs (five individual indicators and three composites).

    Note that PQI 09 and PSI 17 are not listed alongside the PDIs, but these indicators are calculated using the PDI module since they are based on discharges of patients aged 17 years and under. PQI 09 uses in-hospital live births as the denominator. PSI 17 uses all in-hospital newborns as the denominator. The PQI 09 Standalone Module and the PSI 17 Standalone Module calculate these two indicators, respectively, without the need to run the entire PDI module. These two standalone modules are available as separate downloads from the AHRQ QIs Web site.

4.3   Prevention Quality Indicators (PQIs) Background

The PQI module contains 13 individual indicators and 3 composite indicators that measure adult hospital admissions for ambulatory care–sensitive conditions (ACSCs) across geographic areas. PQI 09 is not included in the total of 13 indicators because it is based on pediatric discharges and, hence, is calculated by the PDI module.

ACSCs represent conditions for which hospitalization could be avoided if the patient receives timely and adequate outpatient care. Many factors influence the quality of outpatient care, including access to care and, once care is obtained, adequately prescribed treatments. In addition, patient compliance with those treatments and other patient factors may play a role. In general, areas with lower socioeconomic status (SES) tend to have higher admission rates for ACSCs than areas with higher SES. As with utilization indicators, there are no "right rates" of admission for these conditions. Very low rates could signal inappropriate underutilization of health care resources, while very high rates could indicate potential overuse of inpatient care.

Therefore, hospital admission for ACSCs is not a measure of hospital quality but a potential indicator of outpatient and community health care need. For example, if an area has a relatively high hospital admission rate for diabetes complications, the local health care providers should work with the community to identify reasons for and strategies to address the problem.

Except for perforated appendix, each indicator is measured as the number of hospital admissions for a particular ACSC divided by the residential population in an area.

4.4   Patient Safety Indicators (PSIs) Background

The PSI module contains 24 indicators that reflect the quality of care inside hospitals. PSI 17 is not included in the list of 24 PSIs since it is based on pediatric discharges and, hence, is calculated by the PDI module. The indicators include two groups of measures based on hospital stays.

1. There are 17 provider-level PSIs for medical conditions and surgical procedures that have been shown to have complication/adverse event rates that vary substantially across institutions and for which evidence suggests that high complication/adverse event rates may be associated with deficiencies in the quality of care. These indicators are measured as rates—the number of complications/adverse events divided by the number of admissions for the procedure or condition. The provider-level indicators include only those cases where a secondary diagnosis code flags a potentially preventable complication.

   Eight of these indicators are for surgical discharges, eight are for either medical or surgical discharges, and four are for obstetric discharges. Six of the provider-level PSIs (PSI 03 Pressure Ulcer Rate, PSI 09 Perioperative Hemorrhage or Hematoma Rate, PSI 10 Postoperative Physiologic and Metabolic Derangement Rate, PSI 11 Postoperative Respiratory Failure Rate, PSI 12 Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate, and PSI 14 Postoperative Wound Dehiscence Rate) incorporate information about when procedures were performed (relative to the admission date) if this information is available. Note, however, that if the day-of-procedure information is missing, the computed rates for these indicators will be slightly lower than if the information was available. Admission type is used by four of the PSIs (PSI 10, PSI 11, PSI 13 Postoperative Sepsis Rate, and PSI 17) to identify elective surgeries and newborn admissions.

   Note that PSI 02 Death Rate in Low-Mortality Diagnosis Related Groups (DRGs) is reported as a single provider-level measure (observed and risk adjusted). A single measure is necessary to ensure adequate reliability of the provider-level rates by pooling an infrequent event over a large group of patients. However, the denominator for the indicator is very heterogeneous, and the mortality rate among the low-mortality MS-DRGs varies by MS-DRG type. Users should compare the observed rate to the risk-adjusted rate, which accounts for differences among hospitals in patient case mix; i.e., age, gender, MS-DRG, and comorbidities. For example, a hospital may have a high PSI 02 observed rate only because the hospital has a higher than average share of adult medical MS-DRGs.

   The software does not report expected rates, risk-adjusted rates, and smoothed rates for the following indicators: PSI 17 Birth Trauma Rate – Injury to Neonate, PSI 18 Obstetric Trauma Rate – Vaginal Delivery With Instrument, and PSI 19 Obstetric Trauma Rate – Vaginal Delivery Without Instrument. These measures are not risk adjusted, so only the numerators, denominators, and observed rates are reported.

2. There are seven area-level PSIs. These indicators are similar to provider-level indicators except that the numerator uses principal diagnosis in addition to secondary diagnoses in order to capture all cases of the complication (as opposed to only those complications that develop during a given hospital admission). These measures are not risk adjusted, so only the numerators, denominators, and observed rates are reported.

3. SAS QI v5.0 stratifies PSI 04 Death Rate among Surgical Inpatients with Serious Treatable Complications by the five treatable complications contained in the overall indicator: deep vein thrombosis/pulmonary embolism, pneumonia, sepsis, shock/cardiac arrest, and gastrointestinal hemorrhage/acute ulcer. SAS QI v5.0 does not report smoothed rates for the strata; all other results reported for the overall indicator are also reported for the strata. The strata results may not equal the sum of the overall results because the strata are not mutually exclusive.

5.0   Data Elements and Coding Conventions

See Appendix C for a detailed description of the input data elements and coding conventions used by the SAS QI® v5.0 software.

5.1   Software Input Data

This software was written to process data from discharge data abstracts that contain information about hospital stays. However, not all discharge data records should necessarily be included in a dataset for analysis. For example, the AHRQ QIs focus on acute care, not including hospice or swing bed patients. Discharge records for hospice patients can be dropped from the input data file using either the type of bill or point of origin data elements. These modules were tested on data from the Healthcare Cost and Utilization Project (HCUP, see Acknowledgments).

- The input data file for the QI software must be a SAS dataset.

- It is strongly recommended that users recode data elements in their input file to be consistent with the coding expected by the software. This step will minimize the number of internal changes that will be necessary in the software. For example, recoding the SEX data element in the input file to be consistent with the coding described in Appendix C (i.e., "1" for male and "2" for female) is easier than modifying all uses of the SEX data element in the SAS programs.

- Not every value for every data element described in Appendix C is referenced by the software. For example, only two of the discharge disposition (DISP) data element values are used in the software (DISP value "2" for short-term hospital and value "20" for died in the hospital). However, the complete set of values is included in Appendix C. In many, but not all, instances, the coding values are consistent with HCUP standards to assist users of the uniform HCUP data files.

- To minimize internal changes to the software, all required data elements should be present in the input data file. If a required data element is not available, a placeholder data element (i.e., a variable with the same name and format as the required data element but with missing values) should be provided. Failure to provide a placeholder data element will result in errors during the execution of the SAS programs.

- Six of the indicators (PDI 08, PDI 09, PSI 04, PSI 10, PSI 11, and PSI 13) use admission type (ATYPE) to identify elective surgeries. If admission type is not available in the user's data, then the user may want to evaluate other data in the file to create a proxy to identify elective admission types.

- The SAS QI software does not recognize external cause of injury (E-code) variable names explicitly. If the input data file contains E-code variables, these need to be included with the diagnosis codes (DXn) for the software to utilize the contents of these fields. This is accomplished by simply renaming the E-code fields in the input file before running the SAS QI software. For example, an input data file containing 20 diagnosis code variables and 5 E-code variables would initially contain the following variables: DX1–DX20 and ECODE1–ECODE5. These E-code variables must be renamed as DX21–DX25 (bringing the total number of diagnostic codes to 25) prior to running the

software. If the E-code variables have corresponding POA flags, the flag variables should be renamed to match the secondary diagnosis POA variables (DXPOAn).

The data elements listed in Appendix C are those required for the input data files for all four of the SAS QI v5.0 modules. When a variable is not required for the program, the notation "Not used by the QI program" will be present in the Comments column. Standardizing the variables and data values in the input data file will facilitate use of any of the SAS QI v5.0 software modules.

- Appendix C has been standardized to represent the input data file specifications required for use with any of the software modules. If a specific variable is not used by the program, it is not necessary to create a placeholder variable in the input data file. For example, the variable APR_DRG is used only by the IQI module, so it is not necessary to have this data element in the input data file or create a placeholder variable for the PDI, PQI, and PSI modules to run correctly.

The data element PSTCO is used to define the geographic area for the area-based QIs. It is named with a starting "P" to emphasize the importance of calculating the area-level indicators by the location of the patient residence. If the user wants to calculate the area-level indicators based on the population of the metropolitan area or county associated with the patient residence, the values for this variable should be the Federal Information Processing Standards (FIPS) State/county code associated with each individual patient's place of residence. If the patient information is not available or the user wants to calculate the area-level indicators using the population associated with the hospital location as the denominator, the values for this variable should be the individual hospital FIPS State/county codes.

- If the hospital FIPS code is used in PSTCO, users should be aware that rates may be biased for hospitals that serve as regional referral centers. These hospitals are likely to treat patients from outside the metropolitan area, county, or even the State in which the facility is located.

- Users no longer have to use the modified FIPS codes assignment for area denominators. However, that option is still available. In the modified FIPS codes, certain independent cities (e.g., Baltimore City, Carson City, and St. Louis City) and areas within Hawaii and Virginia are assigned to different area groupings in the modified FIPS categories.

- Using the patient FIPS State/county code for analysis may more accurately reflect the true population at risk. Using the hospital FIPS State/county code for analysis should be done with caution and using larger geographic areas.to minimize the bias with patients that come from a different county than the hospital location.

- It is possible that some records in the input data file may be missing the patient FIPS code. Users should be aware that any records with missing values for PSTCO are excluded from the calculations of observed, risk-adjusted, and smoothed area-level rates. They will be included in the output from the first program of each module (IQSAS1.SAS, PDSAS1.SAS, PQSAS1.SAS, and PSSAS1.SAS).

- The software will generate area-level rates for each county included in the PSTCO data field. If using the hospital FIPS State/county code for analysis, users are encouraged to limit cases in their input file to those patients discharged from the geographic area of interest. For example, if you are using data from the State of Wisconsin and are interested in generating a rate for Wisconsin, you should remove the cases where the patient's county of residence (FIPS code) is from another State. Otherwise, the total or overall rate will include the population at risk from the counties outside Wisconsin.

The software provides the user with the option of producing output by metropolitan area or by county. When metropolitan area is selected, urban areas are always defined by metropolitan areas. When county is selected, urban areas will be defined by county. Rural areas are always defined by county.

- In the software programs, the MALEVL parameter should be set as follows:
  0=county level with U.S. Census FIPS
  1=county level with modified FIPS
  2=metropolitan area with OMB 1999 definition
  3=metropolitan area with OMB 2003 definition

The metropolitan area definitions are from three different sources:

1. The "modified FIPS" definition is from the Area Resource File. The mapping is from county to modified FIPS county; e.g., Baltimore city to Baltimore County.

2. The "OMB 1999 definition" is from OMB Bulletin No. 99-04 (last revised May 6, 2002). The mapping is from county to Metropolitan Statistical Area (MSA), except in New England, where counties are assigned to New England County Metropolitan Area (NECMA). OMB defines NECMA as a county-based alternative to the city- and town-based New England MSA and Consolidated MSA (CMSA). For example, Hampden and Hampshire Counties in western Massachusetts are assigned to the Springfield, MA, NECMA even though the town of Holland in Hampden County is part of the Boston MSA.

3. The "OMB 2003 definition" is from OMB Bulletin No. 03-04 (last revised December 4, 2005). The mapping is from county to either MSA or Micropolitan Statistical Area.

5.2   Coding of Diagnoses, Procedures, MS-DRGs, and MDC

- Diagnoses and procedures must be coded using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM).

- Significant modifications to ICD-9-CM codes occurred in the early 1990s. AHRQ QI definitions only reflect codes valid on and after October 1, 1994, so the software may not accurately analyze data collected before October 1994.

Diagnosis and procedure codes should be in character strings, should not contain any decimal points, and should be left justified. Diagnosis codes with fewer than five digits should be padded

with spaces (not zeros) on the right. Procedure codes with fewer than four digits should be padded with spaces (not zeros) on the right.

- The SAS QI v5.0 software assumes accurate and specific coding of ICD-9-CM codes. If an ICD-9-CM code is specified using five digits, the software recognizes only five-digit versions of that code and not versions truncated at three or four digits. Similarly, if an ICD-9-CM code is specified using four digits, the software recognizes only four-digit versions of that code and not versions truncated at three digits. For example, 4281 is the ICD-9-CM diagnosis code for left heart failure. If your data are coded less specifically (i.e., 428 is used to designate "heart failure"), these less specific codes are not recognized by the software and will result in undercounting cases.

  MS-DRGs and Major Diagnostic Categories are those derived from the Centers for Disease Control and Prevention (CDC) National Center for Health Statistics and Centers for Medicare & Medicaid Services (CMS) Medicare grouper. The software expects that these values will be in your input file with the MS-DRG effective on the discharge date. The software accepts the data elements DRG and MDC, accounting for the presence of present on admission (POA) data. Your data should be coded accordingly. You may modify the software to use other types of DRGs. However, you should evaluate the impact of using other types of DRGs carefully before making such a change. See the technical documentation on the AHRQ QIs Web site for a detailed discussion of the use of MS-DRGs that do not account for POA.

- SAS QI v5.0 accounts for ICD-9-CM and MS-DRG coding effective through September 30, 2013.

Since the software was originally developed using the HCUP State Inpatient Databases (SID), the data elements in the SAS QI v5.0 software are based on the coding specifications used in those databases. The SID coding specifications are similar to the UB-04 but not identical. For data elements used in the software, crosswalks between the SID and UB-04 coding specifications are included in the SID documentation available at http://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp.

5.3   APR-DRG Variables

It is required that users either use their own grouper software or download and run APR-DRG grouper on their patient discharge data before running the IQI module. The APR-DRG grouper is available on the IQI module download page (see Appendix A for link). Two versions of the APR-DRG grouper software are provided on the download page: one for users of 32-bit SAS and one for users of 64-bit SAS. The user must run the executable file included in the APR-DRG grouper zip package to install the required support files for the software: vcredist_x86.EXE (32-bit) or vcredist_x64.EXE (64-bit). If users are running SAS 32-bit, then they must download and install the corresponding 32-bit components; i.e., APR-DRG grouper, PM (discontinued in SAS QI v5.0), and Visual C++ library. If users are running 64-bit SAS, then they must download and install the corresponding 64-bit components; i.e., APR-DRG grouper, PM, and Visual C++ library.

The APR-DRG grouper software creates APR-DRG categories and associated risk-of-mortality data elements. These APR-DRG variables are used to enhance the risk adjustment of selected IQI provider indicators.

- APR-DRG grouper software must be downloaded and run separately.

- Download the version of the APR-DRG grouper software that matches the architecture of the user's SAS installation (32-bit or 64-bit).

- Users who wish to use APR-DRG results to risk-adjust the provider IQI rates should run the APR-DRG grouper software on their patient discharge data before running the ISAS QI programs. The SAS program APR_DRG_Limited_License.SAS has been provided for this purpose.

5.4   Variables Indicating Diagnoses Present on Admission

The present-on-admission (POA) indicator in hospital administrative data distinguishes medical conditions that are present when patients enter the hospital (i.e., comorbidities or preexisting conditions) from those that first occur during the hospital stay (complications or in-hospital adverse events). Beginning with Fiscal Year 2008 (October 1, 2007), the UB-04 data specification manual includes a POA indicator. POA indicators can be reported with principal and secondary diagnoses, in addition to E-codes. The coding guidelines for POA are available online in Appendix I of the ICD-9-CM Official Guidelines for Coding and Reporting (http://www.cdc.gov/nchs/data/icd/icd9cm_guidelines_2011.pdf).

Reporting of POA indicators may vary by hospital. For example, CMS considers certain types of hospitals exempt from POA reporting; for example, critical access hospitals, children's hospitals, and cancer hospitals. However, although these hospitals may be exempt from reporting POA data to CMS, there may be State-specific requirements for POA reporting. Users should be knowledgeable about the POA reporting requirements and practices of hospitals represented in the input data file.

In Version 4 of the SAS QI software, the Prediction Module (PM) estimated the prevalence of conditions when POA data were missing. Beginning with SAS QI v5.0 software, the PM is not included and the handling of POA information has been revised. When using the SAS QI v5.0 software, the user must specify whether or not the input data has POA information. Set the global parameter USEPOA to "1" in the CONTROL SAS file if the input data file has POA data. Set the global parameter USEPOA to "0" in the CONTROL SAS file if the input data file does not have POA data.

5.4.1 When the Input Data File to the SAS QI v5.0 Software Includes POA Information

The ICD-9-CM Official Guidelines for Coding and Reporting identify some diagnoses that are exempt from POA reporting for one of the following reasons: (1) They represent circumstances regarding the health care encounter, (2) they indicate factors influencing health status that do not represent a current disease or injury, or (3) they are always present on admission. Some

examples of the exempt diagnosis codes include old myocardial infarction, normal delivery, congenital anomalies, "V" diagnosis codes indicating a history of disease, and E-codes specific to accidents. For the diagnoses that are exempt from POA reporting, the SAS QI v5.0 software assumes that the diagnosis is present on admission and did not occur during the hospital stay.

For diagnoses for which the ICD-9-CM Official Guidelines for Coding and Reporting require POA reporting, the SAS QI v5.0 software uses the following two POA values to identify that the diagnosis was present on admission: "Y" for present at the time of inpatient admission and "W" for provider is unable to clinically determine whether or not condition was present on admission. Any other POA value, including a blank value, will indicate the diagnosis was not present on admission.

- Diagnoses exempt from POA reporting are assumed to be present on admission.

- Nonexempt diagnoses are identified as present on admission by either of the following POA values: "Y" for present at the time of inpatient admission and "W" for provider is unable to clinically determine whether or not condition was present on admission.

- Nonexempt diagnoses are identified as not present on admission by any other POA value, including a blank value.

5.4.2 When the Input Data File to the SAS QI v5.0 Software Does Not Include POA Information

For the diagnoses that are exempt from POA reporting, the SAS QI v5.0 software assumes that the diagnosis is present on admission and did not occur during the hospital stay. When there is no POA information, the SAS QI v5.0 software assumes the diagnosis was not present on admission for all nonexempt diagnoses. This means that patient safety events identified by some of the PSIs and PDIs will be attributed to the hospital stay when, in fact, they were present on admission (but that information was unavailable).

- Diagnoses exempt from POA reporting are assumed to be present on admission.

- Nonexempt diagnoses are identified as not present on admission because the input file does not have the necessary information to know otherwise.

5.5   Use of External Cause of Injury Codes

External cause of injury codes, or E-codes, are used to classify environmental events, circumstances, and conditions as the cause of injury, poisoning, or other adverse events. The use of E-codes is not always required by a State Uniform Billing Committee or a State data organization. Users should be knowledgeable about the E-code requirements and practices of hospitals represented in the input data file. AHRQ has done some methodological work in understanding the completeness of E-coding in hospital billing data. Reports can be found at http://www.hcup-us.ahrq.gov/reports/methods/methods_topic.jsp.

PSI 08 Postoperative Hip Fracture Rate uses E-codes in the exclusion criterion for self-inflicted injury. Beginning with SAS QI v5.0 software, the following indicators no longer use E-codes in

their numerator or denominator definitions: PSI 05, PSI 15, PSI 16, PSI 21, PSI 25, PSI 26, PDI 01, PDI 03, and PDI 13.

The AHRQ SAS QI software does not recognize E-code variable names explicitly. If the input data file contains E-code variables, these need to be recoded as secondary diagnosis codes (DXn) for the software to utilize the contents of these fields. This is accomplished by simply renaming the E-code fields in the input file before running the AHRQ SAS QI software. For example, an input data file containing 20 diagnosis code variables and 5 E-code variables would initially contain the following variables: DX1–DX20 and ECODE1–ECODE5. These E-code variables must be renamed as DX21–DX25 (bringing the total number of diagnostic codes to 25) prior to running the software. If the E-code variables have corresponding POA flags, the flag variables should be renamed to match the secondary diagnosis POA variables (DXPOAn).

5.6   Use of Weights From Complex Surveys

The AHRQ QI software is intended to be used with data that cover an entire patient population (e.g., all discharges from a hospital in a year) or that were sampled from a patient population using simple random sampling. The SAS QI software, beginning with Version 4.1, does not support weighted QI estimates or standard errors for weighted estimates. Thus, analyses using data obtained from a complex sampling design will not produce accurate estimates for the population from which the data were sampled. For a more thorough description of weighted AHRQ QI analyses, see Guidance for Using the AHRQ Quality Indicators with the Nationwide Inpatient Sample and Other Complex Sampling Designs (http://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp).

In SAS QI v5.0, there is no reference or use of any weighting variable; e.g., the variable DISCWT. This change ensures that the SAS programs do not account for complex sampling design when calculating QI estimates and standard errors. The SAS QI software versions prior to 4.1 supported weighted analyses with appropriate standard errors using discharge-level weights supplied by the user. In Versions 4.1–4.5, which included the PM that handles missing POA data, the SAS QI software retained the weighting procedures in the SAS programs but did not account for complex sampling design and weighting without further manipulation of the SAS programs by users.

5.7   Missing Values

The SAS QI v5.0 programs do not distinguish among different types of missing values.

- Cases that are missing data in fields used for indicator definitions or for risk adjustment (such as age and sex) will be excluded from analysis.

Data files of hospital discharge abstract data may have numeric data elements coded using special SAS missing "dot" values. For example, besides the standard SAS value of "." for missing data, there might also be present values of ".A" for invalid data or ".C" for inconsistent data. However, the SAS QI v5.0 software does not distinguish among the different types of

missing codes. Therefore, all types of missing values in the input data must be represented by a single value: missing data (".") for numeric variables and blank (" ") for character variables.

5.8   Treatment of Missing Data

The software is designed to handle missing data in a particular manner; specifically, the software requires confirmation for the assignment of a poor outcome or negative event. For instance, in order to be assigned as a death, each case must actually be coded as a death. Missing data are considered neutral. Missing data for some data elements result in the exclusion of that case from the denominator. For other data elements, the case is retained. Tables 14, 15, 16, and 17 list the impact of missing data for key data elements in the SAS QI v5.0 software.

Table 14. Treatment of Missing Data Elements in IQI Module

VARIABLE	LABEL	D	N	E	S	TREATMENT OF MISSING DATA
AGE	Age in years at admission	●	●		●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
ASOURCE	Admission source			●		Case excluded from denominator where used in specification (e.g., IQI 32)
DISP	Disposition status		●	●		Case excluded from denominator where used in specification (e.g., IQI 15)
DQTR	Discharge quarter	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
DX1	Principal diagnosis code	●	●	●	●	Record excluded from analysis
SEX	Patient gender	●	●		●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
PAY 1	Payer				●	Classified as "Other"
POINTOFORIGINUB04	Point of origin	●		●		Case excluded from the denominator for IQI 32 (along with ASOURCE)
PSTCO	Location of patient residence or hospital location— modified FIPS State/county code	●				Dropped from denominator in rate calculations (stratified by county or metro area); case will appear in calculation of the overall rate
RACE	Race				●	Classified as "Other"
YEAR	Discharge year	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)

Note: D=denominator; E=exclusion; N=numerator; S=stratification
FIPS: Federal Information Processing Standards; IQI: Inpatient Quality Indicator

Table 15. Treatment of Missing Data Elements in PDI Module

VARIABLE	LABEL	D	N	E	S	TREATMENT OF MISSING DATA
AGE	Age in years at admission	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
AGEDAY	Age in days (coded only when the age in years is less than 1)					Value treated as if it was less than 29 days
ATYPE	Admission type	●				Case excluded from denominator where used in specification
DISP	Disposition status		●	●		Case excluded from denominator where used in specification (i.e., PDI 06 and NQI 02)
DQTR	Discharge quarter	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
DX1	Principal diagnosis code	●	●	●	●	Record excluded from analysis
DXPOAn	Indication of the diagnoses present on admission		●	●		If POA value is blank on an exempt diagnosis, diagnosis is assumed to be present on admission
LOS	Length of stay	●		●		Case excluded from denominator where used in specification
SEX	Patient gender	●	●		●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
PAY1	Payer				●	Classified as "Other"
PSTCO	Location of patient residence or hospital location—modified FIPS State/county code	●				Dropped from denominator in rate calculations (stratified by county or metro area); case will appear in calculation of the overall rate
RACE	Race				●	Classified as "Other"
YEAR	Discharge year	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)

Note: D=denominator; E=exclusion; N=numerator; S=stratification
FIPS: Federal Information Processing Standards; NQI: Neonatal Quality Indicator; PDI: Pediatric Quality Indicator; POA: present on admission

Table 16. Treatment of Missing Data Elements in PQI Module

VARIABLE	LABEL	D	N	E	S	TREATMENT OF MISSING DATA
AGE	Age in years at admission	●	●		●	Case excluded from all analyses (e.g., dropped from numerator of all population-based measures and from denominator of the discharge-based indicator PQI 02)
DQTR	Discharge quarter	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
DX1	Principal diagnosis code	●	●	●	●	Record excluded from analysis
SEX	Patient gender	●	●		●	Case excluded from all analyses (e.g., dropped from numerator of all population-based measures and from the denominator of the discharge-based indicator PQI 02)
PAY 1	Payer				●	Classified as "Other"
PSTCO	Location of patient residence or hospital location—modified FIPS State/county code	●			●	Dropped from denominator in rate calculations (stratified by county or metro area); case will appear in calculation of the overall rate
RACE	Race				●	Classified as "Other"
YEAR	Discharge year	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)

Note: D=denominator; E=exclusion; N=numerator; S=stratification
FIPS: Federal Information Processing Standards; PQI: Prevention Quality Indicator

Table 17. Treatment of Missing Data Elements in PSI Module

VARIABLE	LABEL	D	N	E	S	TREATMENT OF MISSING DATA
AGE	Age in years at admission	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
ATYPE	Admission type	●				Case excluded from denominator where used in specification (e.g., PSI 10)
DISP	Disposition status		●	●		Case excluded from denominator where used in specification (e.g., PSI 04 and PSI 05)
DQTR	Discharge quarter	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
DX1	Principal diagnosis code	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
DXPOAn	Indication of the diagnoses present on admission		●	●		If POA value is blank on an exempt diagnosis, diagnosis is assumed to be present on admission
LOS	Length of stay	●		●		Case excluded from denominator where used in specification (e.g., PSI 03)
SEX	Patient gender	●	●		●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)
PAY1	Payer				●	Classified as "Other"
PSTCO	Location of patient residence or hospital location—modified FIPS State/county code	●				Dropped from denominator in rate calculations (stratified by county or metro area); case will appear in calculation of the overall rate
RACE	Race				●	Classified as "Other"
YEAR	Discharge year	●	●	●	●	Case excluded from all analyses (e.g., dropped from denominator of the discharge-based indicators and from numerator of all population-based measures)

Note: D=denominator; E=exclusion; N=numerator; S=stratification
FIPS: Federal Information Processing Standards; PSI: Patient Safety Indicator; POA: present on admission

6.0   User Feedback for Future Updates

The SAS QI® v5.0 software was developed and implemented with discharge data available to AHRQ through the Healthcare Cost and Utilization Project (HCUP). The goal for the software development was to create the tools, illustrate their use, and then encourage others to adopt and use the tools for their own applications. Users are encouraged to consider how AHRQ may modify or enhance the software to better serve user measurement needs and interests.

- Modifications to the definitions of outcomes of interest (numerators) or populations at risk (denominators) are possible but not desirable. Maintaining consistent definitions is important. Once definitions are altered, the ability to compare indicators based on original definitions is lost. AHRQ encourages users to identify ways to improve the AHRQ QI methodology and to share their suggestions with AHRQ for future software updates.

AHRQ provides public access to HCUPnet (http://hcupnet.ahrq.gov), which is an interactive tool for identifying, tracking, analyzing, and comparing statistics on hospital care. HCUPnet and the National Healthcare Quality Report generate statistics in a table format using data from the National (Nationwide) Inpatient Sample (NIS) and State Inpatient Database (SID) using a modified version of the SAS QI software. HCUPnet includes statistics based on SAS QI v4.1, which have been applied to the HCUP NIS. For information on the calculation of these rates using the modified version of SAS QI v4.1, see http://www.hcup-us.ahrq.gov/reports/methods/2012_03.pdf.

7.0 Producing Quality Indicator Rates: Processing Steps

The six steps below describe the AHRQ QI calculations. The next section of this document (Section 8.0) describes the specifics of each software component of the SAS QI® v5.0 software.

An outcome of interest is the number of cases with the indicator outcome, such as mortality or a procedure.

The AHRQ QIs are expressed as a volume, a count, or a rate, depending on the indicator. For indicators that are expressed as a rate, the calculation of the observed rate is shown below:

$$\frac{Outcome\ of\ interest}{Population\ at\ risk} \qquad [1]$$

$$\{or\}$$

$$\frac{Numerator}{Denominator} \qquad [2]$$

A multiplier can be applied to the observed rate. In common practice, observed rates are multiplied by 100,000 to produce the rates per 100,000 for the population at risk or by 1,000 to produce rates per 1,000 discharges. The SAS QI v5.0 software does not apply multipliers to the observed rates. However, the user is encouraged to transform the rates obtained from the software to a more meaningful unit of measurement.

Conceptually, five steps are necessary to produce most of the AHRQ QI rates (six steps are required for PQI rates). The following instructions describe the steps and how the software performs them.

Note

In the sections that follow, a graphic like this one will appear wherever one or more modules or indicators diverge from the steps being discussed.

These graphics will contain information on exceptions to the rule, relevant substitution steps, and other indicator- or module-specific instructions.

7.1   Step 1: Identify Outcomes in Inpatient Records

Inpatient records are marked to indicate whether they contain the outcome of interest (numerator, or "T" for "top") for each of the AHRQ QIs.

Records are marked by setting a series of flag variables, each of which corresponds to the numerator for a particular indicator. For example, if the inpatient record meets the conditions for inclusion in the outcome for IQI 01, then the outcome variable for IQI 01(TPIQ01) is set to "1" by the SAS QI v5.0 software.

This step requires one pass through the discharge-level data and outputs a discharge-level SAS dataset containing the flag indicator variables for the outcomes for each indicator in its respective module. This dataset also contains the original input variables, except for the diagnosis and procedure variables, which have been removed to reduce the size of the file.

IQI
PSI
PDI

The IQI, PSI, and PDI modules contain some indicators that are expressed as counts or volumes. For these indicators, Step 1 is all that is necessary to calcuate the results.

The remaining steps are relevant for the indicators which are expressed as rates as opposed to volumes or counts.

7.2   Step 2: Identify Populations at Risk

For provider-level indicators, the populations at risk (the denominators for calculating the indicator rates, or "pop") are derived from the hospital discharge records.
For the area-level indicators, the populations at risk (the denominators for calculating the indicator rates) are derived from U.S. Census population figures defined by county in all areas of the U.S. or by metropolitan area in urban areas and by county in rural areas.

7.3   Step 3: Calculate Observed Quality Indicator Rates

Using the output SAS dataset from Step 1 and either hospital discharge or U.S. Census population data from Step 2, the indicator rates are calculated for user-specified combinations of stratifiers. These stratifiers include hospitals, age groups, race/ethnicity categories, sex, and payer categories for the provider-level indicators and areas (counties or metropolitan areas), age groups, race/ ethnicity categories, and sex for the area-level indicators. This step outputs the observed rates for user-specified categories, alone or in combination. For example, observed rates for provider-level indicators could be output at the hospital level, at the payer level, or at the hospital level by payer.

- The software calculates observed rates regardless of the number of cases available. However, rates based on only a few cases should be interpreted with caution.

In some performance measurement work, it is often recommended that rates be suppressed when there are fewer than 30 cases in the denominator. This exclusion rule serves two purposes: It eliminates unstable estimates based on too few cases and it helps to protect the identities of hospitals and patients.

7.4   Step 4: Risk-Adjust the Quality Indicator Rates

Regression coefficients from a reference population database (reflecting a large proportion of the U.S. population) are applied to the individual cases in the risk adjustment process. These reference population file regression coefficients are provided as part of the SAS QI v5.0 software. The risk-adjusted rates for the provider-level indicators will then reflect the age, sex, condition/severity, and comorbidity distribution in the reference population rather than the distribution for the hospitals in the user's data. Similarly, the risk-adjusted rates for the area-level indicators will reflect the age and sex distribution in the reference population rather than the distribution for the areas in the user's data. This approach will allow risk-adjusted rates produced by various users to be compared directly to one another. The code to generate these reference population coefficients is not part of the SAS QI v5.0 software.

QI

This step applies to both provider- and area-level indicators.

Indicators that are not risk adjusted are noted in the risk adjustment tables available on the applicable module resources page on the AHRQ QIs™ Web site (http://www.quality indicators.ahrq.gov/ modules/Default.aspx).

- The software calculates risk-adjusted rates regardless of the number of cases available. However, rates based on only a few cases should be interpreted with caution.

7.5   Step 5: Create Multivariate Signal Extraction (MSX) Smoothed Rates

Shrinkage factors are applied to the risk-adjusted rate for each indicator in a process called multivariate signal extraction, or MSX. These shrinkage factors were calculated from the HCUP SID. For each indicator, the shrinkage estimate reflects an adjustment unique to that indicator. The less consistent (i.e., less reliable or stable) estimates of the indicator are over time and across hospitals or areas, the more the estimate "shrinks" the indicator toward the overall mean. The resulting rate will appear "smoother" than the observed rate, meaning that the year-to-year fluctuations in performance are likely to be reduced. For stratified indicators, smoothed rates are not calculated for the strata composing the overall indicator; the shrinkage factors for the strata are set to "0." The shrinkage factors are provided as part of the SAS QI v5.0 software and do not need to be calculated by users. More information on interpreting smoothed rates is contained in Appendix B.

7.6   Step 6: Calculate Condition-Specific Rates (PQI Only)

For selected PQI, data are available on the prevalence of the relevant condition. The SAS QI v5.0 software incorporates State-level estimates of diabetes prevalence by age from the CDC National Diabetes Surveillance System (see Appendix A). The four PQI related to diabetes (PQI 01 Diabetes Short-Term Complications Admission Rate, PQI 03 Diabetes Long-Term Complications Admission Rate, PQI 14 Uncontrolled Diabetes Admission Rate, and PQI 16 Lower-Extremity Amputation among Patients with Diabetes Rate) can be calculated using the number of diabetics in the State as the denominator, stratified by age.

8.0 Program Descriptions

This section describes the SAS QI® v5.0 programs that assign, calculate, and print results (see Table 18). For each program, there is a description, a list of input and output files, and an explanation of changes to the program code that may be required. The flow of data through the programs is shown in the flowcharts in Section 3.0.

- All of the naming conventions for the programs have been standardized in this document so that *XX* in a program file name denotes the specific module. For example, *XX*FMTS can be interpreted as IQFMTS, PDFMTS, PQFMTS, or PSFMTS, depending on which module is being run (IQI, PDI, PQI, or PSI, respectively).

- Two new standalone modules have been provided for SAS QI v5.0—PQI 09 Standalone Module and PSI 17 Standalone Module. These modules allow users to calculate rates for PQI 09 and PSI 17 without running the complete PDI module. Each of these new standalone modules are implemented the same way as the complete PDI module (described below).

Table 18. Summary of SAS Programs

FUNCTION	IQI MODULE	PDI MODULE	PQI MODULE	PSI MODULE
File locations and options	CONTROL_IQI.SAS	CONTROL_PDI.SAS	CONTROL_PQI.SAS	CONTROL_PSI.SAS
Create format file	IQFMTS.SAS	PDFMTS.SAS	PQFMTS.SAS	PSFMTS.SAS
Identify discharges in numerator and denominator	IQSAS1.SAS	PDSAS1.SAS	PQSAS1.SAS	PSSAS1.SAS
Stratified risk categories	-	PDSASG2.SAS	-	-
Provider observed rates	IQSASP2.SAS	PDSASP2.SAS	-	PSSASP2.SAS
Provider risk-adjusted and smoothed rates	IQSASP3.SAS	PDSASP3.SAS	-	PSSASP3.SAS
Provider composite rates	IQI_COMPOSITE.SAS	PDI_COMPOSITE.SAS	-	PSI_COMPOSITE.SAS
Area observed rates	IQSASA2.SAS	PDSASA2.SAS	PQSASA2.SAS	PSSASA2.SAS
Area risk-adjusted and smoothed rates	IQSASA3.SAS	PDSASA3.SAS	PQSASA3.SAS	-
Condition-specific rates	-	-	PQSASC2.SAS	-

IQI: Inpatient Quality Indicator; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; PSI: Patient Safety Indicator

If you desire to create and examine observed rates, then you will need to use the CONTROL_*XX*I, *XX*FMTS, and *XX*SAS1 programs, followed by the *XX*SASP2 (for provider-level indicators) and/or *XX*SASA2 (for area-level indicators) programs. If you also wish to create risk-adjusted and smoothed rates, then you will need to run the *XX*SASP3 (for provider-level indicators) and/or the *XX*SASA3 (for area-level indicators) programs.

PDI

The PDI module offers two alternatives for analyzing provider-level rates, stratification, and risk adjustment.

If you wish to create stratified provider-level PDIs, you will need to run the PDSASG2 program.

PQI

If you wish to create condition-specific (diabetes) rates in the PQI module, you will need to run the PQSASC2 program.

PSI

For the PSI module, risk-adjusted and smoothed rates are only calculated for provider-level indicators, not for area-level indicators.

8.1 Modify Statements in the CONTROL_*XX*I.SAS Program

The CONTROL_*XX*I.SAS program contains most of the SAS statements that you need to modify in order to run the remaining module programs. This location is where you specify, for example, the path names of all your input and output datasets. There is also a TITLE line that the user can fill in. The items that need to be changed in order to run the *XX*SAS1, *XX*SASP2, PDSASG2, PQSASC2, *XX*SASP3, *XX*SASA2, and *XX*SASA3 programs are described below.

- The CONTROL_*XX*I.SAS program is automatically executed by the remaining module programs. You do not need to run the CONTROL_*XX*I.SAS program separately.

- All of the changes needed for the CONTROL_*XX*I.SAS program are listed in the following descriptions for the other module programs. Each program description contains a section labeled "Changes" that enumerates the modifications for CONTROL_*XX*I.SAS that are associated with that particular program.

- Lines of SAS code to be modified are identified by the comment "<===USER MUST modify," which means the user *must* make the change, or by "<===USER MAY modify," which means the modification is optional.

In all of the remaining programs included with the SAS QI v5.0 modules, there is one line of code near the beginning of each program that needs to be modified. This line of code starts with the phrase "FILENAME CONTROL." You **must** modify this line to point to the path name where you stored your modified copy of the CONTROL_*XX*I.SAS file. Path names should not exceed 255 characters in length.

CONTROL_*XX*I.SAS creates a collection of SAS libraries for accessing input and output datasets from different file paths. For example, "LIBNAME IN0" points to the location of your input dataset for the program *XX*SAS1, and "LIBNAME OUT1" points to the location of the output dataset created by the *XX*SAS1 program. The user must specify path names for these SAS libraries, which may be different from one another. If you wish to read in and write out all of the data to the same location, it is recommended that you make a global change in CONTROL_*XX*I.SAS, from "C:\pathname" to the single directory location that you wish to use.

There is a global PRINT parameter in CONTROL_*XX*I.SAS that may be used to print all of the output summary records at the end of the *XX*SASP2, *XX*SASP3, PDSASG2, PQSASC2,

*XX*SASA2, and *XX*SASA3 programs. These printouts may be quite large if you have a large database with many hospitals and/or many areas (e.g., counties, metropolitan areas) and if you choose the results to be finely stratified. Set PRINT equal to "0" to turn this feature off, and set PRINT equal to "1" to turn this feature on. The feature is turned off by default.

- The MALEVL global parameter in the CONTROL_*XX*I.SAS program instructs all programs on how to define geographic areas (see Section 5.1). By default, this parameter is set to use county for geographic area.

- The USEPOA global parameter in the CONTROL_*XX*I.SAS program instructs the PSI, PDI, and IQI programs on whether or not the input data file includes indications that the diagnoses are present on admission (see Section 5.4). By default, this parameter is set to indicate that POA data are available.

8.2 Run *XX*FMTS

The *XX*FMTS program defines a format library, which contains the diagnosis and procedure screens necessary for assigning the outcomes of interest. This format library is used by most of the other SAS programs. The first few formats in this program are for the stratifiers; i.e., age, sex, race/ethnicity, and payer. These are followed by formats that are used for the identification of outcomes of interest in the *XX*SAS1 program and by formats that map FIPS county codes to metropolitan areas in the *XX*SAS1, *XX*SASA2, and *XX*SASA3 programs. At the end of the program are formats used to assign age, modified MS-DRG, and comorbidity categories for the risk adjustment process implemented in *XX*SASP3 and *XX*SASA3 and formats used with APR-DRGs in *XX*SASP3.

Input:

None

Output:

Permanent SAS format library (FMTLIB)

Changes:

1. You must modify the "FILENAME CONTROL" statement at the beginning of the program to change the path so that it points to your location of the CONTROL_*XX*I.SAS code.

2. In CONTROL_*XX*I.SAS, specify the location (path) of the format library in the "LIBNAME LIBRARY" statement.

8.3 Run *XX*SAS1

The *XX*SAS1 program processes hospital discharge abstract data and flags inpatient records if they contain outcomes of interest. Outcome indicator names, or numerators, have a prefix of "T" (indicating "top"). Stratifier variables are constructed at the beginning of the program.

This program assumes that the input data file (consisting of inpatient discharge abstract data) conforms to specific variable names, attributes, and coding conventions. See the Quick References section (Section 3.0) for variable names and attributes for the input data file.

Input:

1. User-supplied SAS inpatient dataset consisting of administrative hospital discharge abstract data. This dataset is a discharge-level file with an array of diagnosis and procedure codes, among other data elements.

   PDI and PSI

   In the PDI and PSI modules, the dataset also includes variables identifying POA conditions for provider-based outcomes of interest (QPPDxx and QPPSxx, respectively).

2. SAS format library (FMTLIB) created from the *XX*FMTS program.

Output:

1. SAS dataset containing inpatient records with input variables, stratifiers, comorbidity variables, and flag indicators (TP*XX*nn and TA*XX*nn, where *XX* refers to the QI set and "nn" refers to the indicator number) for the outcomes of interest that will later form the numerators for the QI rates.

2. PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of all of the numeric variables and a PROC CONTENTS of the output dataset are written to hardcopy.

3. A PROC PRINT of the first 24 observations in the output dataset is written to hardcopy.

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_*XX*I.SAS code.

2. In CONTROL_*XX*I.SAS, specify the locations (paths) of the input and output files in the "LIBNAME IN0" and "LIBNAME OUT1" statements.

3. In CONTROL_*XX*I.SAS, specify the names of the input and output files in the "INFILE0" and "OUTFILE1" statements. Note that SAS file references must not include file extensions. The default file name may be used for "OUTFILE1."

4. To define urban areas by metropolitan area rather than by county, change the MALEVL parameter in CONTROL_*XX*I.SAS from "0" to "1," "2," or "3." Rural areas will be defined by county no matter how MALEVL is specified. Refer to Section 5.1 for a list of values for the MALEVL parameter.

   - The QI modules assume that your starting SAS dataset contains 30 diagnoses and 30 procedures. If these numbers are different in your input inpatient data, then modify the NDX and NPR parameters in CONTROL_*XX*I.SAS.

   - If your variables are named differently from those used in the SAS QI v5.0 software (see Appendix C for coding specifications), you **must** either rename those variables prior to running this program or modify *XX*SAS1 to include the renaming of your

variables to match those expected by the software. Similarly, if your variables are not the same type (i.e., character or numeric) as those expected by the software, you **must** modify your variables prior to running this program.

Additional Changes for the IQI Module:

1. In the IQI module, if you wish to use APR-DRG variables in the later IQSASP3 program to risk-adjust the provider-level indicators, then in CONTROL_IQI.SAS, set the APRDRGFG flag parameter to "1." If you do not intend to run IQSASP3 to risk-adjust the provider-level indicators or if you do not have the APR-DRG variables available to you, then set APRDRGFG to "0." See Table 19 below.

2. Also in the IQI module, if you wish to risk-adjust the provider-level indicators by later running the IQSASP3 program, then in CONTROL_IQI.SAS, set the APRDRG, APRDRG_RISK_MORTALITY, and XPRDRG_RISK_MORTALITY parameters to be the names of the DRG category variable and the mortality indicators created by APR-DRG software. If you do not intend to use APR-DRG software, then set the APRDRG, APRDRG_RISK_MORTALITY, and XPRDRG_RISK_MORTALITY parameters to equal "0." See Table 19 below.

IQI

Additional changes
for the IQI module
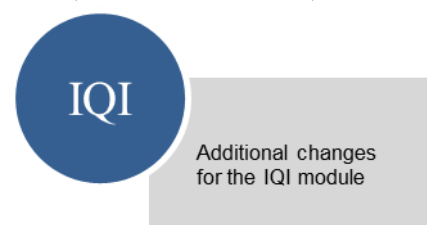
Table 19. How To Set Up IQI Parameters and Your Data for Using APR-DRG Variables

	IF YOU DO NOT INTEND TO RISK-ADJUST THE PROVIDER-LEVEL INDICATORS	IF YOU ARE GOING TO RUN IQSASP3 TO RISK-ADJUST THE PROVIDER-LEVEL INDICATORS AND YOU HAVE APR-DRG SOFTWARE AVAILABLE	IF YOU ARE GOING TO RUN IQSASP3 TO RISK-ADJUST THE PROVIDER-LEVEL INDICATORS AND YOU DO NOT HAVE APR-DRG SOFTWARE AVAILABLE
Preliminary data processing	None	Run APR-DRG software to create APR-DRGs and mortality indicators	None
Setting the APRDRGFG parameter in CONTROL_IQI.SAS	Set to equal "0"	Set to equal "1"	Set to equal "0"
Setting the APR_DRG, APRDRG_RISK_ MORTALITY, and XPRDRG_RISK_ MORTALITY parameters in CONTROL_IQI.SAS	No action required	Set to equal the names of the variables output from the APR-DRG software	Set to equal "0"

APR-DRG: All Patient Refined Diagnosis-Related Group

8.4   Run *XX*SASP2

The *XX*SASP2 program calculates the observed rates for the provider-level indicators (except for those in the IQI module that are reported as a volume) using the data derived in a previous step (*XX*SAS1). These observed rates are stratified by combinations of providers, sex, age, race, and payer categories. The program first totals the indicator flags created by the *XX*SAS1 program and then, for each of the desired stratifiers, divides these totals by the hospital discharges in the at-risk population for the indicator. The population denominators are stored in variables with names that have a prefix of "P." The observed rates are stored in variables that have a prefix of "O."

The *XX*SASP2 program does not apply to the PQI module as those indicators are all area-level measures. If only using the PQI module or if provider-level estimation is not desired, refer to Section 8.6 for details related to area-level estimation.

PQI — The *XX*SASP2 program does not apply to the PQI module.

PQIs are all area-level measures.

IQI — The *XX*SASP2 program does not apply to the volume indicators in the IQI module.

The IQI volume indicators are IQI 01 through IQI 07.
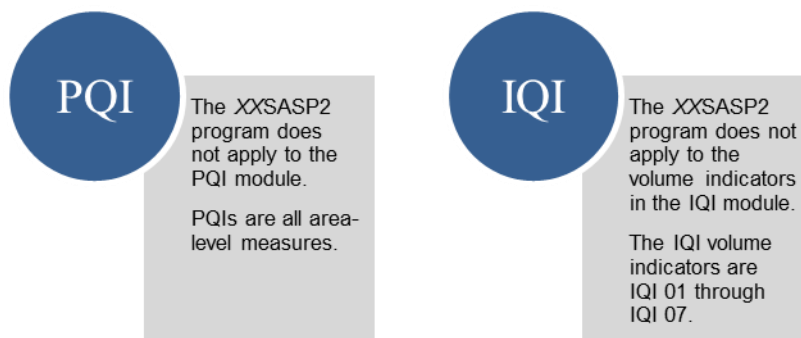
Input:

1. The SAS dataset that was created in the *XX*SAS1. This dataset is a discharge-level file that contains inpatient records with input variables, stratifiers, and the flag indicators for the provider-level QI outcomes of interest.

2. SAS format library (FMTLIB) created from the *XX*FMT program.

Output:

1. SAS dataset with summary records that contain observed rates (OP*XX*nn variables where "nn" refers to the indicator number), the counts of outcomes that formed the numerators of the rates (TP*XX*nn variables), and the hospital discharge totals that formed the denominators of the observed rates (PP*XX*nn variables). It also includes variables identifying POA conditions for provider-level outcomes of interest (QP*XX*nn). The output file has records summarized to the various combinations of stratifiers specified in the TYPELVLP parameter that is described in the "Changes" section below. Note that the observed rates and the denominator totals are not generated for the provider-level volume indicators (IQI 01–IQI 07).

2. An optional ASCII (comma-delimited) text file that the user can then import into a spreadsheet. This text file contains the same information as the SAS output dataset. The text file will contain the OP*XX*nn observed rates, the TP*XX*nn counts of outcomes that formed the numerators of the rates, and the PP*XX*nn counts of outcomes that formed the

denominators of the rates. The different records/rows in the text file will correspond to the different TYPELVLP stratification combinations.

3. A PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of the provider-level summary records that shows statistics for the OP*XX*nn observed rates, the TP*XX*nn counts of outcomes that formed the numerators of the rates, and the PP*XX*nn counts of outcomes that formed the denominators of the rates. These means will only be generated if the user included a value of "16" (for IQI and PSI) or "64" (for PDI) for the TYPELVLP parameter discussed in the "Changes" section below.

4. A PROC CONTENTS of the output SAS summary dataset is generated in the SAS output window/results viewer.

5. A PROC PRINT of the output summary dataset may be generated in the SAS output window/results viewer. This printout may be quite large depending on the number and the types of stratifications that the user requests with the TYPELVLP parameter discussed in the "Changes" section below. If the user does not wish to generate this printout, then set the global "PRINT" parameter in CONTROL_*XX*I.SAS code to "0."

6. The output summary dataset may be written to a comma-delimited CSV file. If the user wishes to create this file, then set the global "TEXTP2" parameter CONTROL_*XX*I.SAS code to "1."

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_*XX*I.SAS code.

2. In CONTROL_*XX*I.SAS, specify the locations (paths) of the input and output SAS files in the "LIBNAME IN1" and "LIBNAME OUTP2" statements.

3. In CONTROL_*XX*I.SAS, specify the names of the input and output files in the "INFILE1" and "OUTFILP2" statements. The name that you specify with INFILE1 should be for the file that you created using the *XX*SAS1 program. The default names for these files may be used.

4. In CONTROL_*XX*I.SAS, specify the levels of aggregation for the observed rates.

   This step is done by specifying numbers between "0" and "31" (for IQI and PSI) or "0" and "127" (for PDI) in the "%LET TYPELVLP=" statement. Each number corresponds to a different level or combination of levels as shown in Table 20 and Table 21. The default values of "0" and "16" (for IQI and PSI) or "0" and "64" (for PDI) will provide an overall total and provider-level totals.

   - If TYPELVLP includes the value "0," then the first observation in the output summary data file will contain the overall totals and observed rates for the entire database created with the *XX*SAS1 program.

- For example, if you are using a State inpatient hospital database, you might specify the following TYPELVLP values for the IQI module:
  - "0"–provides overall rates for your entire State
  - "8"–provides overall rates for your State, broken down by age groups
  - "16"–provides rates for providers within your State
  - "24"–provides rates for age groups within these providers

5. In CONTROL_*XX*I.SAS, if you wish to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then specify the path (including the file name) for this ASCII text file in the "FILENAME *XX*TEXTP2" statement and set the TEXTP2 parameter to "1." Otherwise, the default value of "0" for TEXTP2 will skip the code that would generate this file.

Table 20. IQSASP2 and PSSASP2 Aggregation Possibilities

TYPELVLP	Stratification Provider	Stratification Age	Stratification Sex	Stratification Payer	Stratification Race
0	Overall				
1					Race
2				Payer	
3				Payer*	Race
4			Sex		
5			Sex*		Race
6			Sex*	Payer	
7			Sex*	Payer*	Race
8		Age			
9		Age*			Race
10		Age*		Payer	
11		Age*		Payer*	Race
12		Age*	Sex		
13		Age*	Sex*		Race
14		Age*	Sex*	Payer	
15		Age*	Sex*	Payer*	Race
16	Provider				
17	Provider*				Race
18	Provider*			Payer	
19	Provider*			Payer*	Race
20	Provider*		Sex		
21	Provider*		Sex*		
22	Provider*		Sex*	Payer	Race
23	Provider*		Sex*	Payer*	Race
24	Provider*	Age			
25	Provider*	Age*			Race

TYPELVLP	Stratification Provider	Stratification Age	Stratification Sex	Stratification Payer	Stratification Race
26	Provider*	Age*		Payer	
27	Provider*	Age*		Payer*	Race
28	Provider*	Age*	Sex		
29	Provider*	Age*	Sex*		Race
30	Provider*	Age*	Sex*	Payer	
31	Provider*	Age*	Sex*	Payer*	Race

Note: TYPELVLP values of "0" (overall) and "16" (provider) are the default values for the levels of stratification provided in the software.

Table 21. PDSASP2 Aggregation Possibilities

TYPELVLP	Stratification Provider	Stratification Bwht	Stratification Ageday	Stratification Age	Stratification Sex	Stratification Payer	Stratification Race
0	Overall	Overall	Overall	Overall	Overall	Overall	Overall
1							Race
2						Payer	
3						Payer*	Race
4					Sex		
5					Sex*		Race
6					Sex*	Payer	
7					Sex*	Payer*	Race
8				Age			
9				Age*			Race
10				Age*		Payer	
11				Age*		Payer*	Race
12				Age*	Sex		
13				Age*	Sex*		Race
14				Age*	Sex*	Payer	
15				Age*	Sex*	Payer*	Race
16			Ageday*				
17			Ageday				Race
18			Ageday			Payer	
19			Ageday			Payer*	Race
20			Ageday		Sex		
21			Ageday		Sex*		Race
22			Ageday		Sex*	Payer	
23			Ageday*		Sex*	Payer*	Race
24			Ageday*	Age*			
25			Ageday*	Age*			Race
26			Ageday*	Age*		Payer	

TYPELVLP	Stratification Provider	Stratification Bwht	Stratification Ageday	Stratification Age	Stratification Sex	Stratification Payer	Stratification Race
27			Ageday*	Age*		Payer*	Race
28			Ageday*	Age*	Sex		
29			Ageday*	Age*	Sex*		Race
30			Ageday*	Age*	Sex*	Payer	
31			Ageday*	Age*	Sex*	Payer*	Race
32		Bwht					
33		Bwht*					Race
34		Bwht*				Payer	
35		Bwht*				Payer*	Race
36		Bwht*			Sex		
37		Bwht*			Sex*		Race
38		Bwht*			Sex*	Payer	
39		Bwht*			Sex*	Payer	Race
40		Bwht*		Age			
41		Bwht*		Age*			Race
42		Bwht*		Age*		Payer	
43		Bwht*		Age*		Payer*	Race
44		Bwht*		Age*	Sex		
45		Bwht*		Age*	Sex*		Race
46		Bwht*		Age*	Sex*	Payer	
47		Bwht*		Age*	Sex*	Payer*	Race
48		Bwht*	Ageday				
49		Bwht*	Ageday*				Race
50		Bwht*	Ageday*			Payer	
51		Bwht*	Ageday*			Payer*	Race
52		Bwht*	Ageday*		Sex		
53		Bwht*	Ageday*		Sex*		Race
54		Bwht*	Ageday*		Sex*	Payer	
55		Bwht*	Ageday*		Sex*	Payer*	Race
56		Bwht*	Ageday*	Age			
57		Bwht*	Ageday*	Age*			Race
58		Bwht*	Ageday*	Age*		Payer	
59		Bwht*	Ageday*	Age*		Payer*	Race
60		Bwht*	Ageday*	Age*	Sex		
61		Bwht*	Ageday*	Age*	Sex*		Race
62		Bwht*	Ageday*	Age*	Sex*	Payer	
63		Bwht*	Ageday*	Age*	Sex*	Payer*	Race
64	Provider						

TYPELVLP	Stratification Provider	Stratification Bwht	Stratification Ageday	Stratification Age	Stratification Sex	Stratification Payer	Stratification Race
65	Provider*						Race
66	Provider*					Payer	
67	Provider*					Payer*	Race
68	Provider*				Sex		
69	Provider*				Sex*		Race
70	Provider*				Sex*	Payer	
71	Provider*				Sex*	Payer*	Race
72	Provider*			Age			
73	Provider*			Age*			Race
74	Provider*			Age*		Payer	
75	Provider*			Age*		Payer*	Race
76	Provider*			Age*	Sex		
77	Provider*			Age*	Sex*		Race
78	Provider*			Age*	Sex*	Payer	
79	Provider*			Age*	Sex*	Payer*	Race
80	Provider*		Ageday				
81	Provider*		Ageday*				Race
82	Provider*		Ageday*			Payer	
83	Provider*		Ageday*			Payer*	Race
84	Provider*		Ageday*		Sex		
85	Provider*		Ageday*		Sex*		Race
86	Provider*		Ageday*		Sex*	Payer	
87	Provider*		Ageday*		Sex*	Payer*	Race
88	Provider*		Ageday*	Age			
89	Provider*		Ageday*	Age*			Race
90	Provider*		Ageday*	Age*		Payer	
91	Provider*		Ageday*	Age*		Payer*	Race
92	Provider*		Ageday*	Age*	Sex		
93	Provider*		Ageday*	Age*	Sex*		Race
94	Provider*		Ageday*	Age*	Sex*	Payer	
95	Provider*		Ageday*	Age*	Sex*	Payer*	Race
96	Provider*	Bwht					
97	Provider*	Bwht*					Race
98	Provider*	Bwht*					
99	Provider*	Bwht*					Race
100	Provider*	Bwht*			Sex		
101	Provider*	Bwht*			Sex*		Race
102	Provider*	Bwht*			Sex*	Payer	

TYPELVLP	Stratification Provider	Stratification Bwht	Stratification Ageday	Stratification Age	Stratification Sex	Stratification Payer	Stratification Race
103	Provider*	Bwht*			Sex*	Payer	Race
104	Provider*	Bwht*		Age			
105	Provider*	Bwht*		Age*			Race
106	Provider*	Bwht*		Age*		Payer	
107	Provider*	Bwht*		Age*		Payer*	Race
108	Provider*	Bwht*		Age*	Sex*		
109	Provider*	Bwht*		Age*	Sex*		
110	Provider*	Bwht*		Age*	Sex*	Payer	
111	Provider*	Bwht*		Age*	Sex*	Payer*	Race
112	Provider*	Bwht*	Ageday				
113	Provider*	Bwht*	Ageday*				Race
114	Provider*	Bwht*	Ageday*			Payer	
115	Provider*	Bwht*	Ageday*			Payer*	Race
116	Provider*	Bwht*	Ageday*		Sex		
117	Provider*	Bwht*	Ageday*		Sex*		Race
118	Provider*	Bwht*	Ageday*		Sex*	Payer	
119	Provider*	Bwht*	Ageday*		Sex*	Payer*	Race
120	Provider*	Bwht*	Ageday*	Age			
121	Provider*	Bwht*	Ageday*	Age*			Race
122	Provider*	Bwht*	Ageday*	Age*		Payer	
123	Provider*	Bwht*	Ageday*	Age*		Payer*	Race
124	Provider*	Bwht*	Ageday*	Age*	Sex		
125	Provider*	Bwht*	Ageday*	Age*	Sex*		Race
126	Provider*	Bwht*	Ageday*	Age*	Sex*	Payer	
127	Provider*	Bwht*	Ageday*	Age*	Sex*	Payer*	Race

Note: TYPELVLP values of "0" (overall) and "64" (provider) are the default values for the levels of stratification provided in the software.
Bwht: Birthweight

8.5   Run *XX*SASP3

The *XX*SASP3 program calculates risk-adjusted rates by patient age, sex, birth weight (in the PDI module only), modified MS-DRG, Clinical Classifications Software comorbidity, and APR-DRG, if available, for each QI and then calculates smoothed rates. The risk-adjusted and smoothed rates are not calculated for the provider-level volume indicators in the IQI module (IQI 01 to IQI 07), just as observed rates were not calculated for these indicators.

The *XX*SASP3 program does not apply to the PQI module as those indicators are all area-level measures.

- The programs calculate risk-adjusted rates regardless of the number of cases available. However, rates based on only a few cases should be interpreted with caution.

The output SAS dataset has records summarized to the various combinations of stratifiers that were specified in the TYPELVLP parameter of the preceding *XX*SASP2 program. See Table 20 and Table 21 above.

Input:

1. SAS format library (FMTLIB) created from the *XX*FMT program.

2. The discharge-level file that was created with the *XX*SAS1 program.

3. The SAS dataset with summary records that was created with the *XX*SASP2 program.

4. A text file containing logistic regression coefficients from a regression that was run on a reference SID dataset. These coefficients will be used in the risk adjustment process.

5. Two files are provided as part of the SAS QI software: A text file containing two (in PDI) or three (in IQI and PSI) arrays for use in the smoothing process. The arrays contain noise variance estimates, signal variance estimates, and mean area rates for each QI. Specify file MSX*XX*P45.TXT. The text file does not need to be converted to a SAS file for use with the software.

Output:

1. A SAS dataset with an overall summary record and with provider-level summary records that contain the three types of indicator rates, along with the components of the initial raw rates. Depending on the QI module, the file may contain the observed rates (OP*XX*nn variables), the risk-adjusted rates (RP*XX*nn variables), the smoothed rates (SP*XX*nn variables), the expected rates (EP*XX*nn variables), risk-adjusted rate confidence intervals (LPPSnn variables for lower bounds and UPPSnn variables for upper bounds), the counts of outcomes that formed the numerators of the observed rates (TP*XX*nn variables), the smoothed rate standard errors (XPPSnn), and the hospital discharge totals that formed the denominators of the observed rates (PP*XX*nn variables). When stratifications other than hospital are selected, the RP*XX*nn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables.

PSI

Also included in the PSI module are the counts of outcomes that formed the numerators of the observed rates (TPPSxx variables) and the residential population totals that formed the denominators of the observed rates (PPPSxx variables).

The VPPSxx variables are the variances for respective indicators.

In previous versions, these quantities were not saved if the standard error or confidence intervals were presented. For recent versions, this information is required by the composite indicator programs and thus is retained.

2. An optional ASCII (comma-delimited) text file that the user can then import into a spreadsheet. This text file contains the same information as the SAS output dataset. The text file will contain the OP*XX*nn observed rates and their TP*XX*nn and PP*XX*nn

numerator and denominator components, the RP*XX*nn risk-adjusted rates with upper (UPPSnn) and lower (LPPSXX) limits, the SP*XX*nn smoothed rates with their standard errors (XPPSnn), and the EP*XX*nn expected rates. Each record or row in the text file will correspond to a specification group.

3. A PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of the provider-level summary records that shows statistics for the observed, risk-adjusted, and smoothed rates and statistics for the counts of outcomes that formed the numerators and denominators of the observed rates. These means will only be generated if the user included a value of "16" (for IQI and PSI) or a value of "64" (for PDI) for the TYPELVLP parameter of the preceding *XX*SASP2 program (see Table 20 and Table 21).

4. A PROC CONTENTS of the output SAS summary dataset is generated in the SAS output window/results viewer.

5. A PROC PRINT of the output summary dataset may be generated in the SAS output window/results viewer. This printout may be quite large depending on the number and the types of stratifications that the user requested with the TYPELVLP parameter of the preceding *XX*SASP2 program (see Table 20 and Table 21). If the user does not wish to generate this printout, then set the global "PRINT" parameter in CONTROL_*XX*I.SAS code to "0."

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_*XX*I.SAS code.

2. In CONTROL_*XX*I.SAS, specify the locations (paths) of the input and output SAS files in the "LIBNAME IN1," "LIBNAME INP2," and "LIBNAME OUTP3" statements.

3. In CONTROL_*XX*I.SAS, specify in the "INFILE1" statement the name of the discharge-level file that you created with the *XX*SAS1 program. The default file name may be used.

4. In CONTROL_*XX*I.SAS, specify in the "INFILEP2" statement the name of the summary file that you created with the *XX*SASP2 program. The default file name may be used.

5. In CONTROL_*XX*I.SAS, assign the USEPOA global parameter in the CONTROL_*XX*I.SAS program to "1" if the input data include POA information; set the value to "0" if the input data do not include POA information. This is essential to the risk adjustment process because the adjustment in the PSI, PDI, and IQI programs is sensitive to the presence of POA information. By default, this parameter is set to indicate that POA data are available.

6. In CONTROL_*XX*I.SAS, specify in the "FILENAME MSXP" statement the path (including the file name) for the ASCII text file that contains the estimates to smooth the indicator rates. This file is provided as part of the module. Specify the file name as MS*XXX*P45.TXT.

7. In CONTROL_*XX*I.SAS, specify in the "OUTFILP3" statement the name that you wish the output file to have. The default file name may be used.

8. In CONTROL_*XX*I.SAS, if you wish to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then specify the path (including the file name) for this ASCII text file in the "FILENAME *XX*TEXTP3" statement and set the TEXTP3 parameter to "1." Otherwise, the default value of "0" for TEXTA3 will skip the code that would generate this file.

8.6   Run *XX*I_COMPOSITE

The *XX*I_COMPOSITE program calculates the rates for the provider-level composite QI using the data derived from the *XX*SASP3 program. The provider-level composite rate is the weighted average of the observed-to-expected ratios of its component indicators (see the appropriate technical specifications document for a list of the composite indicators' component parts). The weights include component weights and shrinkage weights. The component weights are denominator weights, defined as the relative frequency of the denominators for the component indicators in the reference population. The shrinkage weights are the signal-to-noise ratio, where the signal variance is estimated from the reference population and the noise variance is estimated from the user's data and is unique to each provider in the user's data.

Rates for the area-level composite QI are calculated in the same programs that calculate the rates for the noncomposite area-level indicators. The IQI, PDI, and PSI modules contain provider-level composite indicators. The PQI module contains only area-level composite indicators, and no separate composite file is provided for that module. For each composite indicator in the module, the *XX*I_COMPOSITE program computes the composite rate, the variance and standard error for the composite rate, the weighted denominator, and a confidence interval for the composite rate.

Input:

1. The SAS dataset with an overall summary record and provider-level summary records that was created with the *XX*SASP3 program.

2. A text file containing one array of shrinkage weights for all provider-level composite indicators in the module and, for each provider-level composite in the module, two additional arrays. One of the additional arrays contains the variances and covariances among the component indicators. The other additional array provides an index for mapping the variances and covariances to component indicators. Two separate text files are provided, and the one used by the program depends on whether POA data are available in the input data file. The file MS*XXX*C45.TXT contains the arrays to be used when POA data are present, and the file M*XXX*C45A.TXT contains the arrays to be used when POA data are not present.

Output:

1. A SAS dataset *XX*C3 with an overall summary record and with provider-level summary records that contain, for each composite indicator, the composite rate, the variance of the composite rate, the standard error of the composite rate, the weighted denominator of the composite rate, and the lower and upper bounds of a 95-percent confidence interval around the composite rate.

2. A PROC MEANS (with N and MEAN) of the provider-level summary records that shows statistics for the composite rate, variance of the composite rate, standard error of the composite rate, and weighted denominator of the composite rate.

Changes:

1. At the beginning of the program, specify the locations (paths) for the library containing the *XX*P3 dataset produced by the *XX*SASP3 program, for the library where the output dataset *XX*C3 should be stored, and for the location of the text files MS*XXX*C45.TXT and M*XXX*C45A.TXT.

2. If you wish to modify the denominator weights, change the Wnn values in the program, where "nn" is the number of the component indicator. Note that any weights provided for a composite must sum to one.

8.7 Run *XX*SASA2

The *XX*SASA2 program calculates the observed rates for the area-level QI using the data derived in a previous step (*XX*SAS1). These observed rates can be stratified by combinations of area, sex, age, and race categories. The program first totals the area indicator flags created by the *XX*SAS1 program and then, for each of the desired stratifiers, divides these totals by the pertinent residential population. The population denominators are stored in variables with names that have a prefix of "P." The observed rates are stored in variables that have a prefix of "O."

Input:

1. The SAS dataset that was created in the *XX*SAS1 program. This dataset is a discharge-level file that contains inpatient records with input variables, stratifiers, and the new flag indicators for the QI area-level outcomes of interest.

2. A text file with Census area residential populations, stratified by area, age, sex, and ethnicity categories. The file POP95T13.TXT is currently provided on the AHRQ QIs Web site as a separate download. Set POPYEAR to the year that best matches the discharge data file (yyyy). Users do not need to convert the ASCII text file to a SAS dataset for use with the software.

3. SAS format library (FMTLIB) created from the *XX*FMT program.

Output:

1. SAS dataset with summary records that contain observed rates (OA*XX*nn variables, where *XX* refers to the QI module and "nn" refers to the indicator number), the counts of outcomes that formed the numerators of the rates (TA*XX*nn variables), and the residential population totals that formed the denominators of the observed rates (PA*XX*nn variables). The output file has records summarized to the various combinations of stratifiers specified in the TYPELVLA parameter that is described in the "Changes" section below.

2. An optional ASCII (comma-delimited) text file that the user can then import into a spreadsheet. This text file contains the same information as the SAS output dataset. The text file will contain the OA*XX*nn observed rates, the TA*XX*nn counts of outcomes that formed the numerators of the rates, and the PA*XX*nn residential population totals. The different records/rows in the text file will correspond to the different TYPELVLA stratification combinations.

3. A PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of the area-level summary records that shows statistics for the OA*XX*nn observed rates, the TA*XX*nn counts of outcomes that formed the numerators of the rates, and the PA*XX*nn residential population totals. These means will only be generated if the user included a value of "8" for the TYPELVLA parameter discussed in the "Changes" section below.

4. A PROC CONTENTS of the output SAS summary dataset is generated in the SAS output window/results viewer.

5. A PROC PRINT of the output summary dataset may be generated in the SAS output window/results viewer. This printout may be quite large depending on the number and the types of stratifications that the user requests with the TYPELVLA parameter discussed in the "Changes" section below. If the user does not wish to generate this printout, then set the global "PRINT" parameter in CONTROL_*XX*I.SAS code to "0."

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_*XX*I.SAS code.

2. In CONTROL_*XX*I.SAS, specify the locations (paths) of the input and output SAS files in the "LIBNAME INA2" and "LIBNAME OUTA2" statements.

3. In CONTROL_*XX*I.SAS, specify the names of the input and output files in the "INFILE1" and "OUTFILA2" statements. The name that you specify with INFILE1 should be for the file that you created using the *XX*SAS1 program. The default file names may be used.

4. In CONTROL_*XX*I.SAS, specify the path (including the file name) for the ASCII population text file in the "FILENAME POPFILE" statement. The file name will be POP95T13.TXT. Set POPYEAR to the year that best matches the discharge data file (*yyyy*).

5. In CONTROL_*XX*I.SAS, specify the levels of aggregation for the observed rates. This change is done by specifying numbers between "0" and "15" in the "%LET TYPELVLA=" statement. Each number corresponds to a different level or combination of levels. The default values of "0" (overall) and "8" (area) will provide an overall total and the area-level totals.

- **WARNING:** TYPELVLA must include the values "0" (overall) and "8" (area) if you wish to subsequently run program *XX*SASA3 for risk-adjusted and smoothed rates.

- If TYPELVLA includes the value "0" (overall), then the first observation in the output summary data file will contain the overall totals and observed rates for the entire database created with the *XX*SAS1 program.

- For example, if you are using a State inpatient hospital database, you might specify the following TYPELVLA values for the IQI module:
  "0"–provides overall rates for your entire State
  "4"–provides overall rates for your State, broken down by age groups
  "8"–provides rates for areas within your State
  "12"–provides rates for age groups within these areas

6. In CONTROL_*XX*I.SAS, if you wish to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then specify the path (including the file name) for this ASCII text file in the "FILENAME *XX*TEXTA2" statement and set the TEXTA2 parameter to "1." Otherwise, the default value of "0" for TEXTA2 will skip the code that would generate this file.

Table 22. IQSASA2, PDSASA2, PQSASA2, and PSSASA2 Aggregation Possibilities

TYPELVLA	Stratification Area	Stratification Age	Stratification Sex	Stratification Race
0	Overall	Overall	Overall	Overall
1				Race
2			Sex	
3			Sex*	Race
4		Age		
5		Age*		Race
6		Age*	Sex	
7		Age	Sex*	Race
8	Area			
9	Area*			Race
10	Area*		Sex	
11	Area*		Sex*	Race
12	Area*	Age		
13	Area*	Age*		Race
14	Area*	Age*	Sex	
15	Area*	Age*	Sex*	Race

Note: TYPELVLA values of "0" (overall) and "8" (area) are the default values for the levels of stratification provided in the software.

8.8　Run PDSASG2

The PDSASG2 program calculates the observed rates for the provider-level PDIs using the data derived in the previous step (PDSAS1). These observed rates are stratified by risk group categories that are specific to each indicator. The program first sums the indicator flags created by the PDSAS1 program (numerator) and then divides this sum by the count of the hospital discharges (denominator) for each of the risk group stratifiers. The stratifiers are stored in variables with names that have a prefix of "G" (indicating "group"). The numerators are stored in variables with names that have a prefix of "T" (indicating "top"). The population denominators are stored in variables with names that have a prefix of "P." The observed rates are stored in variables that have a prefix of "O."

PDI
The PDSASG2 program is only used in the PDI module.
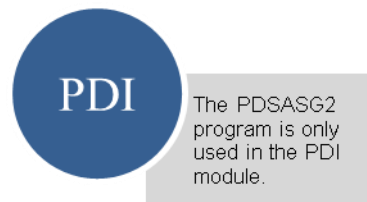
Input:

1. The SAS dataset that was created in the PDSAS1 program. This dataset is a discharge-level file that contains inpatient records with input variables, stratifiers, and the 13 new flag indicators for the PDI hospital outcomes of interest. Only six of these indicators have risk group stratifiers and are included as input into the G2 module (PDI 01, PDI 02, PDI 08, PDI 10, PDI 11, and PDI 12).

2. SAS format library (FMTLIB) created from the PDFMT program.

Output:

1. SAS dataset with summary records that contain observed rates (OPPDnn variables, where "nn" refers to the indicator number), the counts of outcomes that formed the numerators of the rates (TPPDnn variables), and the hospital discharge totals that formed the denominators of the observed rates (PPPDnn variables). It also includes variables identifying POA conditions for provider-level outcomes of interest (QPPDnn).The output file has records summarized to the indicator-specific, predefined risk group stratifiers.

2. An optional ASCII (comma-delimited) text file that the user can then import into a spreadsheet. This text file contains the same information as the SAS output dataset. The text file will contain the OPPDnn observed rates, the TPPDnn counts of outcomes that formed the numerators of the rates, and the PPPDnn counts of outcomes that formed the denominators of the rates. The different records/rows in the text file will correspond to the indicator-specific, predefined risk group stratifiers.

3. A PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of the hospital-level summary records that show statistics for the OPPDnn observed rates, the TPPDnn counts of outcomes that formed the numerators of the rates, the QPPDnn POA flags, and the PPPDnn counts of outcomes that formed the denominators of the rates. These means are generated by the indicator-specific, predefined risk group stratifiers.

4. A PROC CONTENTS of the output SAS summary dataset is generated in the SAS output window/results viewer.

5. A PROC PRINT of the output summary dataset may be generated in the SAS output window/results viewer. If the user does not wish to generate this printout, set the global "PRINT" parameter in CONTROL_PDI.SAS code to "0."

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_PDI.SAS code.

2. In CONTROL_PDI.SAS, specify the locations (paths) of the input and output SAS files in the "LIBNAME IN1" and "LIBNAME OUTG2" statements.

3. In CONTROL_PDI.SAS, specify the names of the input and output files in the "INFILE1" and "OUTFILG2" statements. The name that you specify with INFILE1 should be for the file that you created using the PDSAS1 program. The default file names may be used.

4. In CONTROL_PDI.SAS, if you wish to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then set the TEXTG2 parameter to "1". Otherwise, the default value of "0" for TEXTG2 will skip the code that would generate this file.

5. In CONTROL_PDI.SAS, if you wish to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then specify the path (including the file name) for this ASCII text file in the "FILENAME PDTEXTG2" statement.

8.9   Run *XX*SASA3

The *XX*SASA3 program calculates age and sex risk-adjusted rates for each area-level QI (overall rates and rates by area) and then calculates smoothed rates. This program does not apply to the PSI module.

Input:

1. SAS format library (FMTLIB) created from the *XX*FMT program.

2. The discharge-level file that was created with the *XX*SAS1 program.

3. The SAS dataset with summary records that was created with the *XX*SASA2 program.

4. A text file with Census area residential populations (stratified by area, sex, and discrete age categories). One file, POP95T13.TXT, is currently provided along with the QI software. Set POPYEAR to the year that best matches the discharge data file (yyyy). The text file does not need to be converted to a SAS file for use with the software.

Additional Input Specific to the PDI and PQI Modules:

1. Two text files containing logistic regression coefficients from a regression that was run on the reference SID dataset. These coefficients will be used in the risk adjustment process. COVPDA45.TXT or COVPQA45.TXT should be used with risk adjustment for age and gender only for the PDI and PQI modules, respectively. CVPDA45A.TXT or CVPQA45A.TXT should be used with adjustment for age, gender, and SES for the PDI and PQI modules, respectively. These files are provided to you as part of the QI software and do not need to be converted to a SAS file for use with the software.

2. Two text files containing two arrays for use in the smoothing process. The arrays contain noise variance estimates, signal variance estimates, and mean area rates for each QI. MSXPDA45.TXT or MSXPQA45.TXT should be used with adjustment for age and gender only for the PDI and PQI modules, respectively. MXPDA45A.TXT or MXPQA45A.TXT should be used with adjustment for age, gender, and SES for the PDI and PQI modules, respectively. These files are provided to you as part of the QI software and do not need to be converted to a SAS file for use with the software.

Output:

1. A SAS dataset with an overall summary record and with area-level summary records that contain the three types of indicator rates, along with the components of the initial raw rates. Specifically, the file contains the observed rates (OA*XX*nn variables), the risk-adjusted rates (RA*XX*nn variables), the smoothed rates (SA*XX*nn variables), the lower and upper confidence intervals (LA*XX*nn and UA*XX*nn, respectively), the counts of outcomes that formed the numerators of the observed rates (TA*XX*nn variables), and the residential population totals that formed the denominators of the observed rates (PA*XX*nn variables). When stratifications other than area are selected, the RA*XX*nn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables.

2. An optional ASCII (comma -elimited) text file that the user can then import into a spreadsheet. This text file contains the same information as the SAS output dataset. The text file will contain the OA*XX*nn observed rates and their TA*XX*nn and PA*XX*nn components, the RA*XX*nn risk-adjusted rates, and the SA*XX*nn smoothed rates. Each record or row in the text file will correspond to a different area.

3. A PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of the area-level summary records that shows statistics for the OA*XX*nn observed rates and their TA*XX*nn and PA*XX*nn components, the RA*XX*nn risk-adjusted rates, and the SA*XX*nn smoothed rates.

4. A PROC CONTENTS of the output SAS summary dataset is generated in the SAS output window/results viewer.

5. A PROC PRINT of the output summary dataset may be generated in the SAS output window/results viewer. If the user does not wish to generate this printout, then set the global "PRINT" parameter in CONTROL_*XX*I.SAS code to "0."

6. Outputs to hardcopy are PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of risk-adjusted and smoothed rates in two intermediate work files and of all of the numeric variables in the final output data file.

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_*XX*I.SAS code.

2. In CONTROL_*XX*I.SAS, specify the locations (paths) of the input and output SAS files in the "LIBNAME IN1," "LIBNAME INA2," and "LIBNAME OUTA3" statements.

3. In CONTROL_*XX*I.SAS, specify in the "INFILE1" statement the name of the discharge-level file that you created with the *XX*SAS1 program. The default file name may be used.

4. In CONTROL_*XX*I.SAS, specify the path (including the file name) for the ASCII population text file in the "FILENAME POPFILE" statement. The file name is POP95T13.TXT. These files are provided along with the software. The file used should be the one that is closest to the year associated with your particular data. These files contain Census residential population estimates by area, gender, and discrete age categories.

5. In CONTROL_*XX*I.SAS, specify in the "FILENAME COVARA" statement the path (including the file name) for the ASCII text file that contains regression coefficients from a logistic regression that was run on the reference SID dataset.

6. In the PDI and PQI modules, to perform the risk adjustment by age and gender, use COVPDA45.TXT or COVPQA45.TXT for the PDI and PQI modules, respectively. To perform the risk adjustment by SES, use CVPDA45A.TXT or CVPQA45A.TXT for the PDI and PQI modules, respectively.

PDI and PQI

Additional input for the PDI and PQI modules

7. In CONTROL_*XX*I.SAS in the PDI and PQI modules, specify in the "FILENAME MSX" statement the path (including the file name) for the ASCII text file that contains the estimates to smooth the indicator rates. Use MSXPDA45.TXT or MSXPQA45.TXT for age and gender risk adjustment in the PDI and PQI modules, respectively, and MXPDA45A.TXT or MXPQA45A.TXT for age, gender, and SES risk adjustment in the PDI and PQI modules, respectively.

8. In CONTROL_*XX*I.SAS, specify in the "INFILEA2" statement the name of the summary file that you created with the *XX*SASA2 program. The default file name may be used.

9. In CONTROL_*XX*I.SAS, specify in the "OUTFILA3" statement the name that you want the output file to have. The default file name may be used.

10. In CONTROL_*XX*I.SAS, if you want to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then specify the path (including the file name) for this ASCII text file in the "FILENAME *XX*TEXTA3" statement, and set the TEXTA3 parameter to "1." Otherwise, the default value of "0" for TEXTA3 will skip the code that would generate this file.

8.10   Run PQSASC2

This program is only for use in the PQI module. The PQSASC2 program calculates condition-specific rates for the five diabetes area-level PQI (PDI 15, PQI 01, PQI 03, PQI 14, and PQI 16) using the data derived in the previous step (PQSAS1). These condition-specific rates are stratified by State and age categories. The program first totals the indicator flags created by the PQSAS1 program and then, for each of the stratifiers, divides these totals by the pertinent condition-specific population. The condition-specific denominators are stored in variables with names that have a prefix of "P" (for "population"). The condition-specific rates are stored in variables that have a prefix of "C."

Input:

1. The SAS dataset that was created in the previous step (PQSAS1). This is a discharge-level file that contains inpatient records with input variables, stratifiers, and the four new flag indicators for the selected PQI outcomes of interest; i.e., PQI 01, PQI 03, PQI 14, and PQI 16.

2. A text file with diabetes populations, stratified by State and age categories. The file currently provided along with the PQI module software is QICTYC13.TXT. The user should select the file for the year that best matches the user's discharge data file.

    * Users do **not** need to convert the ASCII text file to a SAS dataset for use with the software.

3. SAS format library (FMTLIB) created from the PQFMTS program.

Output:

1. SAS dataset with summary records that contain condition-specific rates (CAPQnn variables, where "nn" refers to the indicator number), the counts of outcomes that formed the numerators of the rates (TAPQnn variables), and the condition-specific population totals that formed the denominators of the observed rates (PAPQnn variables). The output file has records for the overall State rate and by age.

2. An optional ASCII (comma-delimited) text file that the user can then import into a spreadsheet. This text file contains the same information as the SAS output dataset. The text file will contain the CAPQnn condition-specific rates, the

PQI The PQSASC2 program is for use in the PQI module only.

TAPQnn counts of outcomes that formed the numerators of the rates, and the PAPQnn condition-specific population totals. The different records/rows in the text file will correspond to the overall State rate and by age.

3. A PROC MEANS (with N, NMISS, MIN, MAX, MEAN, and SUM) of the area-level summary records that shows statistics for the CAPQnn condition-specific rates, the TAPQnn counts of outcomes that formed the numerators of the rates, and the PAPQnn condition-specific populations totals. These means will be generated for the overall State rate and by age.

4. A PROC CONTENTS of the output SAS summary dataset is output to hardcopy.

5. A PROC PRINT of the output summary dataset is provided at the end of the hardcopy printout. If the user does not wish to generate this printout, set the global "PRINT" parameter in CONTROL_PQI.SAS code to "0."

Changes:

1. You must change the "FILENAME CONTROL" statement at the beginning of the program to reflect the location of the CONTROL_PQI.SAS code.

2. In CONTROL_PQI.SAS, specify the locations (paths) of the input and output SAS files in the "LIBNAME INC2" and "LIBNAME OUTC2" statements.

3. In CONTROL_PQI.SAS, specify the names of the input and output files in the "INFILE1" and "OUTFILC2" statements. The name that you specify with INFILE1 should be for the file that you created using the previous PQSAS1 program.

4. In CONTROL_PQI.SAS, specify the path (including the file name) for the ASCII population text file in the "FILENAME POPFILE2" statement. The file name will be QICTYC13.TXT. These files are provided to you as part of the PQI module. The file used should be the one that is closest to the year associated with your particular data.

5. In CONTROL_PQI.SAS, if you wish to create an ASCII (comma-delimited) text file that you can import into a spreadsheet, then specify the path (including the file name) for this ASCII text file in the "FILENAME PQTEXTC2" statement, or set the TEXTC2 parameter to "1." Otherwise, the default value of "0" for TEXTC2 will skip the code that would generate this file.

9.0 Reviewing the Printed Output

This section contains tips for reviewing some of the printed output from the QI modules. These tips are oriented toward explaining the interrelationships among printout items from different programs and hopefully will help to reveal the nature and structure of the module outputs. See Appendix D for each module's output data dictionary.

- Depending on the QI module and whether or not you have elected to risk-adjust and smooth the data, the final output may be a PROC PRINT from *XX*SASP2, *XX*SASP3, *XX*SASA2, and/or *XX*SASA3. All interim printouts are for checking and trouble-shooting.

9.1 *XX*SAS1

The initial printout from the *XX*SAS1 program contains PROC MEANS for all of the numeric variables (including the comorbidity indicators) in the output discharge-level dataset. It will contain information for the newly constructed TA*XX*nn and TP*XX*nn flag variables that will later form the numerators for the indicator rates. For each TA*XX*nn and TP*XX*nn flag variable:

- The SUM will contain the total number of observations in the dataset that were found to have the particular outcome of interest.

- For most of the area indicators, the MEAN, MINIMUM, and MAXIMUM will usually be the value "1" since the flag variables have either been set to missing (".") or to a value of "1."

The exceptions to this are PQI 02 and PDI 17 for perforated appendix and PQI 09 for low birth weight, which are based on a subset of the hospitalized population rather than the area residential population. For these indicators, a value of "0" was assigned to the TA*XX*nn flag if a particular observation was part of the population for the rate denominator but did not have the particular outcome of interest to be included in the rate numerator. So, for example, TAPQ02=0 implies a patient who had an appendectomy performed but did not have a perforated appendix. For PQI 02, the MEAN will contain a close approximation of the eventual overall observed indicator rate. The value will change slightly after PQSASA2 has applied additional parts of the indicator definition.

PDI 17, PQI 02, and PQI 09

Exception
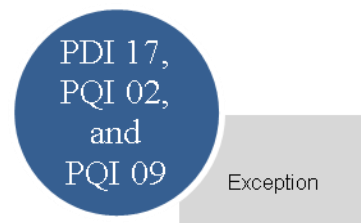
Most of the provider indicators will have a value of "1," "0," or missing ("."). For these indicators, a value of "0" was assigned to the TP*XX*nn flag if a particular observation was part of the population at risk for a particular indicator but did not have the particular outcome of interest. So, for example, TPIQ21=1 indicates a patient who had a Cesarean section, while TPIQ21=0 identifies a patient who had a delivery but not a Cesarean section.

For most of the provider-level indicators, the MEANs will contain a close approximation of the eventual overall observed indicator rates. The values will change slightly after *XX*SASP2 has applied additional parts of the indicator definitions.

N lists the number of observations in the dataset with nonmissing values. For the area-level indicators, N for TA*XX*nn will be the same as the SUM. For most of the provider-level indicators, including PQI 02, N will contain the denominator for the observed indicator rate.

For the six IQI provider-level volume indicators, the MEAN, MINIMUM, and MAXIMUM will usually be the value "1" since the flag variables have either been set to missing (".") or to a value of "1." Also, N for TPIQnn or TAIQnn will be the same as the SUM. Note: The Ns or denominators for six of the IQI mortality indicators (i.e., IQI 08–12, IQI 30, and IQI 31) will be similar to the Ns and SUMs for the six IQI volume indicators (TPIQ01–TPIQ02 and TPIQ04–TPIQ07), but often they will not be exactly identical; e.g., the mortality indicators exclude discharges that were transferred to other hospitals.

There may be differences in the output among the *XX*SAS1.SAS, *XX*SASA2.SAS, and *XX*SASA3.SAS programs based on missing data. If any cases are missing the FIPS codes, they will be included in the output from *XX*SAS1.SAS but will be excluded from the subsequent analyses (the second and third programs).

The *XX*SAS1 printout also contains a PROC CONTENTS that lists all of the variables in the output dataset, including the character variables that are present, and a PROC PRINT of the first 24 observations in the output dataset.

9.2   *XX*SASP2

The purpose of this printout is to provide the observed rates for all provider-level indicators. The default printout shows results by provider, but other levels of output can be specified as well. Note that risk-adjusted and smoothed rates are shown in the output from the next program.

The printout from the *XX*SASP2 program contains PROC MEANS on the provider-level summary records for all of the numeric variables in the output summary dataset. It will contain information for the newly constructed OP*XX*nn rates, the PP*XX*nn denominators, and the TP*XX*nn numerators.

The _TYPE_ variable described in the MEANS table identifies the stratification level for the records in the output dataset. The _TYPE_ variable corresponds to the TYPELVLP parameter values that were specified (see the "Changes" section for the *XX*SASP2 program). In this case, _TYPE_ always assumes the value of "16" (for IQI and PSI) or "64" (for PDI) since only the provider-level records are selected.

The N statistic for _TYPE_ contains the number of providers in the output summary dataset. A TP*XX*nn numerator variable with a value for N that is lower than the N value for _TYPE_ indicates that there were no outcomes of interest for some of the providers. Similarly, a PP*XX*nn denominator variable with a lower value for N than _TYPE_ indicates that, for some providers, there were no hospital discharges with the outcome of interest.

The MINIMUM value for most of the numerators will usually be "0" since values of "0" were assigned for observations that were part of the population for the rate denominator but did not have the particular outcome of interest to be included in the rate numerator. For the IQI volume indicators (TPIQ01–TPIQ02 and TPIQ04–TPIQ07), the MINIMUM value will be "1" or higher.

- For the observed rates, the user should **not** report the MEANS displayed here but instead should refer to the overall means in the output dataset that are also present in the subsequent PROC PRINT. The MEANS given here are means of hospital means; i.e., all hospitals are given equal weight, regardless of the number of discharges in the different hospitals.

The SUMs for the counter variables TP*XX*nn and PP*XX*nn will contain overall file totals for these data elements. The SUMs for the observed rates have no intuitive meaning.

If the "PRINT" parameter in the CONTROL_*XX*I.SAS program is set to "1," the subsequent PROC PRINT output contains a complete dump of the output summary file. Listed for each record are the stratification values, the PP*XX*nn population denominators for the provider indicators, the TP*XX*nn outcome numerators for the provider indicators, and the OP*XX*nn observed rates.

9.3   *XX*SASP3

The PROC PRINT at the end of this program provides your **final output**. (This printout appears if the "PRINT" parameter in the CONTROL_*XX*I.SAS program is set to "1.")

Table 23 lists and describes the column headers shown on the printed output. Each indicator is reported in a separate section, where *XX* refers to the QI module and "nn" corresponds to the two-digit indicator number.

Table 23. Provider-Level Printed Output

COLUMN HEADING	DESCRIPTION
Obs	Observation 1 (with HOSPID=".") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).
HOSPID	Identifier for each provider in the dataset
AGECAT	Age stratification category (see Table 20 and Table 21 for TYPELVLP settings)
SEXCAT	Gender stratification category (see Table 20 and Table 21 for TYPELVLP settings)
PAYCAT	Payer stratification category (see Table 20 and Table 21 for TYPELVLP settings)
RACECAT	Race stratification category (see Table 20 and Table 21 for TYPELVLP settings)
TP*XX*nn	Number of cases in the numerator
PP*XX*nn	Number of cases in the denominator (population at risk)
OP*XX*nn	Observed (raw) rate (numerator divided by denominator)
EP*XX*nn	Expected rate—rates the provider would have if it performed the same as the reference population given the provider's actual case mix (e.g., age, gender, modified MS-DRG, and comorbidities)
RP*XX*nn	Risk-adjusted rate—accounts for the difference between the case mix of the reference population and the provider's case mix. When stratifications other than hospital or area are selected, the RP*XX*nn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables.
LP*XX*nn	Lower limit of confidence interval of risk-adjusted rate
UP*XX*nn	Upper limit of confidence interval of risk-adjusted rate
SP*XX*nn	Smoothed rate—rates with removal of fluctuation over time
XP*XX*nn	Standard error of smoothed rate

MS-DRG: Medicare Severity Diagnosis-Related Group

Observation 1 (with HOSPID=".") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16). Data will appear under the column headers, AGECAT, SEXCAT, PAYCAT, and RACECAT, if you specify these levels of aggregation.

You may wish to express the results in more understandable terms:

- Multiply the mortality rates by 1,000 to express them as per 1,000 discharges; e.g., 0.0338x1,000=33.8 deaths per 1,000 discharges.

- Multiply the utilization rates by 1,000 to express them as per 1,000 discharges; e.g., 0.2040x1,000=204 procedures per 1,000 discharges.

- The MEANS table is generated from the permanent provider-level output file and is provided for trouble-shooting and understanding your data but not for reporting. The means are provided just for the provider-level summary records.

- The N for all but the TP*XX*nn counter variables should contain the number of providers in the user's database.

IQI
Exception

- The MEANS, MINIMUMs, and MAXIMUMs have their normal meaning and provide comparisons among the different hospitals or providers in your database.

- For the (observed, risk-adjusted, or smoothed) rates, the user should **not** report the MEANS displayed here but instead refer to the overall means in the output dataset in the PROC PRINT labeled "FINAL OUTPUT." The MEANS given here are means of hospital means; i.e., all hospitals are given equal weight, regardless of the number of discharges in the different hospitals.

Note, the denominators for seven of the IQI mortality indicators (IQI 08–IQI 12, IQI 30, and IQI 31) will be similar to the totals for the seven IQI volume indicators (IQI 01– IQI 07), but often they will not be exactly identical; e.g., the mortality indicators exclude discharges that were transferred to other hospitals.

If the "PRINT" parameter in the CONTROL_*XX*I.SAS program is set to "1," at the end of the printout is a PROC PRINT on the final provider-level output file. Listed for each level of stratification are the stratifiers, the numerator and denominator totals for the observed rates, and the observed, risk-adjusted, and smoothed rates.

9.4   *XX*SASA2

The purpose of this printout is to provide the observed rates for all area-level indicators. The default printout shows overall results and results by area, but other levels of output can be specified as well. Note that risk-adjusted and smoothed rates are shown in the output from the next program.

The printout from the *XX*SASA2 program contains PROC MEANS for all of the numeric variables in the output summary dataset. It will contain information for the newly constructed OA*XX*nn rates, the PA*XX*nn denominators, and the TA*XX*nn numerators.

The _TYPE_ variable described in the first row of the MEANS table identifies the stratification level for the records in the output dataset. The _TYPE_ variable corresponds to the TYPELVLA parameter values that were specified (see the "Changes" section for the *XX*SASA2 program). In this case, _TYPE_ always assumes the value of "8" since only the area-level records are selected.

The N statistic for _TYPE_ contains the number of areas in the output summary dataset. A TA*XX*nn numerator variable with a lower value for N than _TYPE_ indicates that there were no outcomes of interest for some of the areas.

The MINIMUM value for the TA*XX*nn numerators will be "1" or higher.

PQI
02

Exception

- For the observed rates, the user should **not** report the MEANS displayed here but instead should refer to the overall

means in the output dataset that are also present in the subsequent PROC PRINT. The MEANS given here are means of the area means; i.e., all areas are given equal weight, regardless of the population in the different areas.

In the PQI module, the MINIMUM value for the perforated appendix TAPQnn numerator will usually be "0" since values of "0" were assigned for observations that were part of the population for the rate denominator but did not have the particular outcome of interest to be included in the rate numerator. For the other 12 indicators, based on the residential area population, the MINIMUM value will be "1" or higher.

The SUMs for the counter variables TA*XX*nn and PA*XX*nn will contain overall file totals for these data elements. The SUMs for the observed rates have no intuitive meaning. If the "PRINT" parameter in the CONTROL_*XX*I.SAS program is set to "1," the subsequent PROC PRINT output contains a complete dump of the output summary file. Listed for each record are the stratification values, the PA*XX*nn population denominators for the indicators, the TA*XX*nn outcome numerators for the indicators, and the OA*XX*nn observed rates.

Table 24 lists and describes the column headers shown on the printed output. Each indicator is reported in a separate section, where XX refers to the QI module and "nn" corresponds to the two-digit QI number.

Table 24. Area-Level Printed Output

COLUMN HEADING	DESCRIPTION
Obs	Observation 1 is the overall average for the entire dataset (TYPELVLA=0). The remaining observations are individual areas (TYPELVLA=8).
Area	Identifier in the dataset for area
TA*XX*nn	Number of cases in the numerator
PA*XX*nn	Number of cases in the denominator (population at risk)
OA*XX*nn	Observed (raw) rate (numerator divided by denominator)
RA*XX*nn	Risk-adjusted rate—accounts for the difference between the case mix of the reference population and the area's case mix. When stratifications other than area are selected, the RAPDnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables.
SA*XX*nn	Smoothed rate—rates with removal of fluctuation over time

Observation 1 (with AREA=*blank*) is the overall average for the entire dataset (TYPELVLA=0). The remaining observations are individual areas (TYPELVLA=8).

You may wish to express the results in more understandable terms. Multiply the utilization rates by 100,000 to express them as a rate per 100,000 people; e.g., 0.000494x100,000=49.4 pediatric heart surgeries per 100,000 people.

The MEANS table is generated from the permanent area-level output file. The means are provided just for the area-level summary records.

The N for all but the TA*XX*nn counter variables should contain the number of different areas (metro areas and counties) in your database.

The MEANS, MINIMUMs, and MAXIMUMs have their normal meaning and provide comparisons among the different areas in your database. Note that the maximums for the counter variables (the TA*XX*nn and PA*XX*nn variables) are associated with specific areas, and therefore, these maximums may not match those in the prior *XX*SAS2 printouts since that run typically will include a record for the entire database.

9.5   *XX*SASA3

The PROC PRINT at the end of this program provides your final output. (This printout appears if the "PRINT" parameter in the CONTROL_*XX*I.SAS program is set to "1".) Table 25 lists and describes the column headers shown on the printed output. Each indicator is reported in a separate section, where *XX* refers to the QI module and "nn" corresponds to the two-digit QI number.

Table 25. Final Area-Level Printed Output

COLUMN HEADING	DESCRIPTION
OBS	Observation 1 is the overall average for the entire dataset (TYPELVLA=0). The remaining observations are individual areas (TYPELVLA=8).
AREA	Identifier in the dataset for area
TA*XX*nn	Number of cases in the numerator
PA*XX*nn	Number of cases in the denominator (population at risk)
OA*XX*nn	Observed (raw) rate (numerator divided by denominator)
RA*XX*nn	Risk-adjusted rate—accounts for the difference between the case mix of the reference population and the provider's case mix. When stratifications other than area are selected, the RA*XX*nn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables.
LA*XX*nn	Lower limit of confidence interval of risk-adjusted rate
UA*XX*nn	Upper limit of confidence interval of risk-adjusted rate
SA*XX*nn	Smoothed rate—rates with removal of fluctuation over time
XA*XX*nn	Standard error of smoothed rate
EP*X*nn	Expected rate—rates the area would have if it performed the same as the reference population given the area's actual case mix (e.g., age, gender, modified MS-DRG, and comorbidities)

MS-DRG: Medicare Severity Diagnosis-Related Group

Observation 1 (with AREA=*blank*) is the overall average for the entire dataset (TYPELVLA=0). The remaining observations are individual areas (TYPELVLA=8).

You may wish to express the results in more understandable terms. Multiply the utilization rates by 100,000 to express them as a rate per 100,000 people; e.g., 0.000494x100,000=hysterectomies per 100,000 people.

The MEANS table is generated from the permanent area-level output file. The means are provided just for the area-level summary records.

PQI | The PQSASC2 program and its output are specific to the PQI module.

The N for all but the TA*XX*nn counter variables should contain the number of different areas (metro areas and counties) in your database.

The MEANS, MINIMUMs, and MAXIMUMs have their normal meaning and provide comparisons among the different areas in your database. Note that the maximums for the counter variables (the TA*XX*nn and PA*XX*nn variables) are associated with specific areas, and therefore, these maximums may not match those in the prior *XX*SAS2 printouts since that run typically will include a record for the entire database.

- For the (observed, risk-adjusted, or smoothed) rates, the user should **not** report the means displayed here but instead refer to the overall means in the output dataset that are also present in the subsequent PROC PRINT. The means given here are means of area means; i.e., all areas are given equal weight, regardless of the number of discharges in the different areas.

The sums of the counter variables (the TA*XX*nn and PA*XX*nn variables) yield the overall database totals.

9.6 PQSASC2

This program and its output are specific to the PQI module. The purpose of this printout is to provide the condition-specific rates for selected area-level indicators. The default printout shows results by State and age category. The printout from the PQSASC2 program contains PROC MEANS on the State-level summary records for all of the numeric variables in the output summary dataset. It will contain information for the newly constructed CAPQnn rates, the PAPQnn denominators, and the TAPQnn numerators.

The _TYPE_ variable described in the first column of the MEANS table identifies the stratification level for the records in the output dataset. The _TYPE_ value of "1" corresponds to the State level, while a value of "3" corresponds to the State*age category level.

The N statistic contains the number of States in the output summary dataset.

The minimum value will be "1" or higher (for PAPQnn and TAPQnn) or "0" or higher (for CAPQnn).

- For the condition-specific rates, the user should not report the means displayed here but instead should refer to the overall means in the output dataset that are also present in the subsequent PROC PRINT. The means given here are means of area means; i.e., all areas are given equal weight, regardless of the populations in the different areas.

The sums for the counter variables TAPQnn and PAPQnn will contain overall file totals for these data elements. The SUMs for the *condition-specific* rates have no intuitive meaning.

If the "PRINT" parameter in the CONTROL_PQI.SAS program is set to "1," the subsequent PROC PRINT output contains a complete dump of the output summary file. Listed for each record are the stratification values, the PAPQnn population denominators for the 4 indicators, the TAPQnn outcome numerators for the 16 indicators, and the 4 CAPQnn condition-specific rates.

10.0 User Support

Technical assistance for the QI software is available through an electronic user support system monitored by the AHRQ QIs support team. You may use the same email address to communicate to AHRQ any suggestions for QI enhancements, general questions, and any QI-related comments. AHRQ welcomes your feedback. The email address for user support and feedback is support@qualityindicators.ahrq.gov.

AHRQ also offers a listserv to keep you informed on the QIs. The listserv is used to announce any QI changes or updates, new tools, and resources and to distribute other QI-related information. This is a free service. Simply follow the process described below to begin receiving important QI information. All you need is a computer, Internet access, and an email address. It works just like other electronic distribution lists. Here's how to register:

1. Send an email message to listserv@qualityindicators.ahrq.gov.

2. On the subject line, type "Subscribe."

3. In the body of the message, type "sub Quality_Indicators-L" and your full name; for example, "sub Quality_Indicators-L John Doe."

4. You will receive a message confirming that you are signed up.

If you have any questions, contact AHRQ QIs support at the email noted above. You should receive an automatic response email message confirming receipt. If you do not receive a confirmation message, call 888–512–6090.

Appendix A: Links

The following links may be helpful to users of the AHRQ Quality Indicators™ (QIs):

> http://www.qualityindicators.ahrq.gov/modules/iqi_resources.aspx
> http://www.qualityindicators.ahrq.gov/modules/pdi_resources.aspx
> http://www.qualityindicators.ahrq.gov/modules/pqi_resources.aspx
> http://www.qualityindicators.ahrq.gov/modules/psi_resources.aspx
> http://www.qualityindicators.ahrq.gov/software/default.aspx

Table 26. AHRQ Quality Indicators Version 5.0 Documents and Software

TITLE	DESCRIPTION
IQI Technical Specifications PDI Technical Specifications PQI Technical Specifications PSI Technical Specifications	Provide detailed definitions of each indicator (including composites), including all ICD-9-CM and MS-DRG codes that are included in or excluded from the numerator and denominator. Note that exclusions from the denominator are automatically applied to the numerator.
IQI v5.0 Benchmark Data Tables	Provide the average volume, provider rate, and population rate, as appropriate, for each indicator
PDI v5.0 Benchmark Data Tables	Provide the average volume, provider rate, and population rate, as appropriate, for each indicator
PQI v5.0 Benchmark Data Tables	Provide the average volume, provider rate, and population rate, as appropriate, for each indicator
PSI v5.0 Benchmark Data Tables	Provide the average volume, provider rate, and population rate, as appropriate, for each indicator.
Log of Changes to IQI Documents and Software Log of Changes to PDI Documents and Software Log of Changes to PQI Documents and Software Log of Changes to PSI Documents and Software	Provide a cumulative summary of all changes to the software, software documentation, and other documents made since the release of Version 2.1 of the software in March 2003. Also summarize changes to indicator definitions resulting from all fiscal year changes to ICD-9-CM coding and MS-DRG changes. Changes to indicator specifications that were not a result of new ICD-9-CM and MS-DRG codes are also described in the documents.
IQI Risk Adjustment Coefficient Tables PDI Risk Adjustment Coefficient Tables PQI Risk Adjustment Coefficient Tables PSI Risk Adjustment Coefficient Tables	Provide the stratification and coefficients used to calculate the risk-adjusted rate for each stratum
Quality Indicators Software Instruction	Provides detailed instructions on how to use the SAS® version of the software, including data preparation, calculation of the rates, and interpretation of output
SAS IQI Software SAS PDI Software SAS PQI Software SAS PSI Software	Requires the SAS statistical program distributed by the SAS Institute, Inc. The company may be contacted directly regarding the licensing of its products: http://www.sas.com
Limited License edition of the 3M™ APR-DRG Version 30 grouper	Creates APR-DRG variables for use with the SAS version of IQI software. Instructions for running the software are included in the .zip file.
AHRQ QI Population File	Population data that are constructed from public use Census data and provided for use with the QIs syntax for area-level analyses

TITLE	DESCRIPTION
Version 5.0 Listserv announcement	Announces the release of Version 5.0 of the AHRQ QI software and documentation and provides a summary of changes and links to relevant pages
IQI User Guide: Composite Measures PDI User Guide: Composite Measures PQI User Guide: Composite Measures PSI User Guide: Composite Measures	Provide technical overviews of the composite measures

AHRQ: Agency for Healthcare Research and Quality; APR-DRG: All Patient Refined Diagnosis-Related Group; ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification; IQI: Inpatient Quality Indicator; MS-DRG: Medicare Severity Diagnosis-Related Group; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; PSI: Patient Safety Indicator

QI Windows Version 5.0 Software

The QI Windows® Version 5.0 software calculates rates for all of the AHRQ QI modules and does not require SAS software. It is available at:

http://www.qualityindicators.ahrq.gov/software/default.aspx

Additional Documents

A number of documents are cataloged within the "Archive" section of the AHRQ QIs Web site for historical purposes:

http://www.qualityindicators.ahrq.gov/Archive/default.aspx

Additional documents may be accessed at the AHRQ QIs Modules Web page:

http://www.qualityindicators.ahrq.gov/modules/Default.aspx

Examples of documents available at the above link:

- AHRQ QI Measure Development, Implementation, Maintenance and Retirement
- ICD-9-CM to ICD-10-CM/PCS Conversion of AHRQ Quality Indicators, March 2011
- AHRQ Quality Indicator Empirical Methods, May 2011
- List of AHRQ QI Endorsed by the National Quality Forum

Other documents, including newsletter archives, can be viewed or downloaded from the AHRQ QIs News Web page (current and archived news releases):

http://www.qualityindicators.ahrq.gov/news/default.aspx
http://www.qualityindicators.ahrq.gov/Archive/News.aspx

Other Tools and Information

QI rates can be calculated using the modified Federal Information Processing Standards State/county code. A list of codes is available at:

http://www.census.gov/popest/about/geo/codes.html

AHRQ provides a free, online query system based on Healthcare Cost and Utilization Project data that provides access to health statistics and information on hospital stays at the national, regional, and State level. It is available at:

http://hcupnet.ahrq.gov/

Information on the 3M™ APR-DRG system is available at:

http://solutions.3m.com/wps/portal/3M/en_US/Health-Information-Systems/HIS/Products-and-Services/Classification-and-Grouping/

The Centers for Disease Control and Prevention National Diabetes Surveillance System provides State-level estimates of diabetes prevalence by age and is available at:

http://www.cdc.gov/diabetes/data/

Appendix B: Using Different Types of QI Rates

When should you use the observed, expected, risk-adjusted, and/or smoothed rates generated by the AHRQ QI software? Here are some guidelines.

If the user's primary interest is to identify cases for further followup and quality improvement, then the observed rate would help to identify them. The observed rate is the raw rate generated by the QI software from the user-provided data. Areas for improvement can be identified by the magnitude of the observed rate compared to available benchmarks and/or by the number of patients impacted.

Additional breakdowns by the default patient characteristics used in stratified rates (e.g., age, gender, or payer) can further identify the target population. Target populations can also be identified by user-defined patient characteristics supplemented to the case/discharge–level flags. Trend data can be used to measure change in the rate over time.

Another approach to identifying areas on which to focus is to compare the observed and expected rates. The expected rate is the rate the provider would have if it performed the same as the reference population given the provider's actual case mix; e.g., age, gender, MS-DRG, and comorbidity categories.

If the observed rate is higher than the expected rate (i.e., the ratio of observed/expected is greater than 1.0, or observed minus expected is positive), then the implication is that the provider performed worse than the reference population for that particular indicator. Users may want to focus on these indicators for quality improvement.

If the observed rate is lower than the expected rate (i.e., the ratio of observed/expected is less than 1.0, or observed minus expected is negative), then the implication is that the provider performed better than the reference population. Users may want to focus on these indicators for identifying best practices.

Users can also compare the expected rate to the reference population rate reported in the AHRQ QI software or Comparative Data document to determine how the provider's case mix compares to the reference population. The population rate refers to the overall rate for the reference population. The reference population is defined in the Comparative Data document. If the population rate is higher than the expected rate, then the provider's case mix is less severe than the reference population. If the population rate is lower than the expected rate, then the provider's case mix is more severe than the reference population.

The difference between the population rate and the expected rate to "adjust" the observed rate to account for the difference between the case mix of the reference population and the provider's case mix, which is the provider's risk-adjusted rate.

If the provider has a less severe case mix, then the adjustment is positive (population rate > expected rate) and the risk-adjusted rate is higher than the observed rate. If the provider has a more severe case mix, then the adjustment is negative (population rate < expected rate) and the risk-adjusted rate is lower than the observed rate. The risk-adjusted rate is the rate the provider would have if it had the same case mix as the reference population.

Finally, users can compare the risk-adjusted rate to the smoothed, or "shrinkage," rate to determine whether this difference between the risk-adjusted rate and reference population rate is likely to remain in the next measurement period. Smoothed rates are weighted averages of the population rate and the risk-adjusted rate, where the weight reflects the stability of the provider's risk-adjusted rate.

A ratio of (smoothed rate – population rate)/(risk-adjusted rate – population rate) greater than 0.80 suggests that the difference is likely to persist (whether the difference is positive or negative). A ratio less than 0.80 suggests that the difference may be due in part to random differences in patient characteristics (patient characteristics that are not observed and controlled for in the risk adjustment model). In general, users may want to focus on areas where the differences are more likely to persist.

Appendix C: Data Dictionary

Table 27. QI Program Input Data Dictionary

VARIABLE NAME	DESCRIPTION	FORMAT	VALUE DESCRIPTION	COMMENTS
KEY	Sequence number; unique case identifier	Numeric	User-defined unique numeric identifier for each discharge record	Used by the QIs programs for sorting discharge records and may facilitate possible exploration; allows user to link the records from the *XX*SAS1.SAS program output file back to the original input data file
AGE	Age in years at admission	Numeric	Age in years	If this data element is missing, the discharge record will be excluded from analysis.
AGEDAY	Age in days (coded only when the age in years is less than 1)	Numeric	Age in days	Not used in the IQI program. If not present in the input data file, it is not necessary to create a placeholder variable for this module.
RACE	Race of patient	Numeric (1–6)	1=White 2=Black 3=Hispanic 4=Asian or Pacific Islander 5=Native American 6=other	The values of 1–6are used directly in the QI software. All other ethnicity codes are mapped to an "other" category.
SEX	Sex of patient	Numeric (1 or 2)	1=male 2=female	If this data element is missing, the discharge record will be excluded from the analysis.
PAY1	Expected primary payer	Numeric (1–6)	1=Medicare 2=Medicaid 3=private, including HMO 4=self-pay 5=no charge 6=other	The values of 1–6 are used directly in the QI software. All other payer codes are mapped to an "other" category. This data element is used to stratify only the provider-level IQIs (01–25 and 30–34), provider-level PDIs (01–13), and provider-level PSIs (02–19).
PAY2 (SAS only)	Expected secondary payer	Numeric (1–6)	1=Medicare 2=Medicaid 3=private, including HMO 4=self-pay 5=no charge 6=other	Use is optional but must be present in data (set to missing if data element not available)
PSTCO	Location of patient residence or hospital location	Numeric ssccc	Modified Federal Information Processing Standards State/county code[1]	See Appendix A for link to most recent list of codes. If this data element is missing, the discharge record will be excluded from rate calculations.

VARIABLE NAME	DESCRIPTION	FORMAT	VALUE DESCRIPTION	COMMENTS
HOSPID	Data source hospital number	Numeric (default) or string[2]	Hospital identification number	Not used in the PQI program. Used by other modules to facilitate data exploration and possible trouble-shooting. May also be selected as a stratifier (see Table 22 and Table 23 for provider-level aggregation possibilities).
DISP	Disposition of patient	Numeric (1–7; 20)	1=routine 2=transfer to short-term hospital 3=skilled nursing facility 4=intermediate care 5=another type of facility 6=home health care 7=against medical advice 20=died in the hospital	Not used in the PQI program. The values 2 and 20 are referenced by the QI code (to identify transfers to another short-term hospital and patients who died in the hospital). All other nonmissing values are considered valid disposition codes. This convention is different from that of the AHRQ QI Windows® application.
MORT30 (SAS only)	30-day mortality indicator	Numeric (0 or 1)	0=did not die within 30 days of admission 1=died within 30 days of admission	Use is optional but must be present in data for the IQI programs (set to missing if data element not available)
DNR (SAS only)	Do not resuscitate indicator	Numeric (0 or 1)	0=no "do not resuscitate" indicator 1="do not resuscitate" indicator	Use is optional but must be present in data for all modules except the PQI module (set to missing if data element not available)
ATYPE	Admission type	Numeric (1–6)	1=emergency 2=urgent 3=elective 4=newborn 5=trauma center[3] 6=other	Not used by the IQI program. The values "3" and "4" are referenced by the PDI and PSI code (to identify elective surgeries and newborn admissions). PDI 08–09 and PSI 10, 11, 13, and 17 will be affected if ATYPE values are missing.
ASOURCE	Admission source	Numeric (1–5)	1=emergency room 2=another hospital 3=another facility, including LTC 4=court/law enforcement 5=routine/birth/other	The values "2" and "3" are referenced by the QI code (to identify transfers from another hospital or facility).
LOS	Length of stay	Numeric	Number of days from admission to discharge	Not used by the PQI program
APR_DRG	APR-DRG category	Numeric	3M™ APR-DRG software	Although program options allow the IQI module to operate without these variables, users should run APR-DRG software on their raw data to assign this variable to each case. See Section 5.3 for details on the use of these variables. Not used by the PDI, PQI, or PSI programs. If not present in the input data file, it is not necessary to create a

VARIABLE NAME	DESCRIPTION	FORMAT	VALUE DESCRIPTION	COMMENTS
				placeholder variable to run these three modules.
APRDRG_ RISK_ MORTALITY	APR-DRG mortality score	Numeric	3M™ APR-DRG software risk-of-mortality score	See Section 5.3 for details on the use of these variables. Not used by the PDI, PQI, or PSI programs. If not present in the input data file, it is not necessary to create a placeholder variable to run these three modules.
XPRDRG_ RISK_ MORTALITY	APR-DRG mortality score with POA	Numeric	3M™ APR-DRG software risk-of-mortality score using POA information	See Section 5.3 for details on the use of these variables. Not used by the PDI, PQI, or PSI programs. If not present in the input data file, it is not necessary to create a placeholder variable to run these three modules.
DRG[4]	Medicare Severity Diagnosis-Related Group	Numeric	MS-DRG from Federal (CMS) MS-DRG grouper. The MS-DRG provided should account for POA data.	MS-DRG from Federal (CMS) MS-DRG grouper. The MS-DRG provided should account for POA data.
DRGVER	Medicare Severity Diagnosis-Related Group version	Numeric	Version of Federal (CMS) MS-DRG Grouper	e.g., Version 30 for FY2013
MDC	Major Diagnostic Category	Numeric	MDC from Federal (CMS) MS-DRG grouper	MDC from Federal (CMS) MS-DRG grouper
DX1–DX30	ICD-9-CM diagnosis codes. DX1 is the principal diagnosis, DX2–DX30 are secondary diagnoses.	String; three, four, or five characters (do not include decimal point)	Diagnosis codes	Users with more or fewer secondary diagnoses must modify the number of diagnoses in the parameter "&NDX" in CONTROL_*XX*I.SAS programs. The software can accept more than 30 diagnosis codes. The number provided here is the default. One PSI relies on E-codes. If the dataset contains E-codes in user-defined variables, these variables should be renamed to secondary diagnosis codes (e.g., E-codes would be labeled as DX10 in a data file where the last secondary DX field is DX9). See Section 5.5 for details on the use of E-codes.

VARIABLE NAME	DESCRIPTION	FORMAT	VALUE DESCRIPTION	COMMENTS
DXPOA1– DXPOA30	POA indicator for each diagnosis code	String	Values "Y" and "W" indicate diagnosis present at the time of inpatient admission.	If available, these data elements will be used in the assignment, risk adjustment, and smoothed rates of some of the PSI and PDI indicators. See Section 5.4 for details on the use of POA information.
PR1–PR30	ICD-9-CM procedure codes. PR1 is the principal procedure; PR2–PR30 are secondary procedures.	String; three or four characters (do not include decimal point)	Procedure code	Users with more or fewer secondary procedures must modify the parameter "&NPR" in CONTROL_XXI.SAS to reflect the number of procedures. The software can accept more than 30 procedure codes. The number provided here is the default.
POINTOFORIGINUB04	Point of origin	String, one character	4=transfer from a hospital 5=transfer from a skilled nursing facility or intermediate care facility 6=transfer from another health care facility IF ATYPE=4 (newborn) 5=born inside this hospital 6=born outside of this hospital	Only these values are used by the QI programs.
PRDAY1–PRDAY30	Days from admission to procedure. PR1 is the principal procedure; PR2–PR30 are secondary procedures.	Numeric	Days from admission to procedure[5]	Not used by the PQI program. If not present in the input data file, it is not necessary to create a placeholder variable for this module. Necessary variables if the user sets the "&PRDAY" parameter in CONTROL_XXI.SAS (for PDI, IQI, and PSI) to equal "1." In this case, it is expected that the number of PRDAY variables agrees with the number of procedure codes present. (See footnote 5 below for method of calculation). These variables are not needed if the user sets the "&PRDAY" parameter in CONTROL_XXI.SAS to equal "0," indicating that there is no procedure day information available.

VARIABLE NAME	DESCRIPTION	FORMAT	VALUE DESCRIPTION	COMMENTS
YEAR	Patient's year of discharge. For example, a patient discharged on July 7, 2004, would have a discharge year of "2004."	Numeric	YYYY	Discharge year should be within the range of 1997–2014.
DQTR	The calendar quarter of the patient's discharge. For example, a patient discharged on July 7, 2004, would have a discharge quarter of "3."	Numeric	1=January–March 2=April–June 3=July–September 4=October–December	

AHRQ: Agency for Healthcare Research and Quality; APR-DRG: All Patient Refined Diagnosis-Related Group; CMS: Centers for Medicare & Medicaid Services; E-code: external cause of injury; HMO: health maintenance organization; ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification; IQI: Inpatient Quality Indicator; LTC: long-term care; MDC: Major Diagnostic Category; MS-DRG: Medicare Severity Diagnosis-Related Group; PDI: Pediatric Quality Indicator; POA: present on admission; PQI: Prevention Quality Indicator; PSI: Patient Safety Indicator; ssccc: [INSERT]; QI: Quality Indicator

1 Federal Information Processing Standards (FIPS) as defined by the U.S. Department of Commerce, National Institute of Standards and Technology (formerly National Bureau of Standards). Note: Certain independent cities (Baltimore City, Carson City, and St. Louis City) and areas within Hawaii and Virginia are assigned to different area groupings in the modified FIPS categories as compared to the U.S. Census Bureau groupings. The AHRQ QI software uses the modified FIPS code assignment of these areas. Failure to use the modified FIPS codes assignment will result in the use of incorrect denominator estimates for area indicators. A list is available at http://www.census.gov/popest/geographic/codes02.pdf

2 If HOSPID is not numeric, the user must modify the PRD*XX*P45.TXT file(s) and the *XX*SASP3.SAS programs to accommodate character values in this field since the SAS code is written to handle numeric HOSPID values by default.

3 The ATYPE value "5" was used to indicate delivery only in the 1988 to 1997 Healthcare Cost and Utilization Project data files. The Uniform Billing standards currently use "5" to indicate Trauma Center.

4 See http://hcup-us.ahrq.gov/toolssoftware/comorbidity/comorbidity.jsp.

5 Variables PRDAY1–PRDAY30 are defined as the number of days from date of admission to date of procedure for each procedure. For example, if the patient was admitted on June 15 and had two procedures—the principal procedure on June 15 and a second procedure on June 18—then the value of PRDAY1 would be "0" and the value of PRDAY2 would be "3." For more information, consult the Healthcare Cost and Utilization Project data documentation at http://www.hcup-us.ahrq.gov/db/vars/prdayn/nisnote.jsp.

Appendix D: SAS® Output Data Dictionaries

Table 28. SAS IQI Provider Output

COLUMN HEADING	DESCRIPTION	FORMAT	COMMENTS
OBS	Observation 1 (with HOSPID=".") or " ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric	
HOSPID	Identifier for each provider in the dataset	Text or numeric	Depends on format of HOSPID in source dataset
AGECAT	Age stratification category	Numeric range	
SEXCAT	Gender stratification category	Numeric	1=male 2=female
PAYCAT	Payer stratification category	Numeric	1=Medicare 2=Medicaid 3=private, including HMO 4=self-pay 5=no charge 6=other
RACECAT	Race stratification category	Numeric	1=White 2=Black 3=Hispanic 4=Asian or Pacific Islander 5=American Indian 6=other
TPIQnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric	
PPIQnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric	
OPIQnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric	
EPIQnn	Rate calculated by assuming an "average" performance for each patient group based on the reference population but with the provider's actual case mix	Numeric	
RPIQnn	The estimated rate calculated by adjusting to an "average" case mix	Numeric	When stratifications other than hospital or area are selected, the RPIQnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables
LPIQnn	The lower confidence bound of the risk-adjusted rate	Numeric	
UPIQnn	The upper confidence bound of the risk-adjusted rate	Numeric	
SPIQnn	The smoothed rate calculated using multivariate signal extraction	Numeric	
XPIQnn	Standard error of smoothed rate	Numeric	
VPIQnn	Variance for respective Indicators	Numeric	

HMO: health maintenance organization

Table 29. SAS IQI Area Output

COLUMN HEADING	DESCRIPTION	FORMAT	COMMENTS
OBS	Observation 1 (with MAREA=" ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric	
MAREA	Identifier in the dataset for area	Text	
TAIQnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric	
PAIQnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric	
OAIQnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric	
RAIQnn	The estimated rate calculated by adjusting to an "average" case mix	Numeric	When stratifications other than hospital or area are selected, the RAIQnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables
SAIQnn	The smoothed rate calculated using multivariate signal extraction	Numeric	

Table 30. SAS PDI Provider Output

COLUMN HEADING	DESCRIPTION	FORMAT	COMMENTS
OBS	Observation 1 (with HOSPID="." or " ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric	
HOSPID	Identifier for each provider in the dataset	Text or numeric	Depends on format of HOSPID in source dataset
AGECAT	Age stratification category	Numeric range	
SEXCAT	Gender stratification category	Numeric	1=male 2=female
PAYCAT	Payer stratification category	Numeric	1=Medicare 2=Medicaid 3=private, including HMO 4=self-pay 5=no charge 6=other
RACECAT	Race stratification category	Numeric	1=White 2=Black 3=Hispanic 4=Asian or Pacific Islander 5=Native American 6=other
TPPDnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric	
PPPDnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric	
OPPDnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric	
EPPDnn	Rate calculated by assuming an "average" performance for each patient group based on the reference population but with the provider's actual case mix	Numeric	
RPPDnn	The estimated rate calculated by adjusting to an "average" case mix	Numeric	When stratifications other than hospital or area are selected, the RPPDnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables
LPPDnn	The lower confidence bound of the risk-adjusted rate	Numeric	
UPPDnn	The upper confidence bound of the risk-adjusted rate	Numeric	
SPPDnn	The smoothed rate calculated using multivariate signal extraction	Numeric	
XPPDnn	Standard error of smoothed rate	Numeric	
VPPDnn	Variance for respective indicators	Numeric	

HMO: health maintenance organization

Table 31. SAS PDI Area Output

COLUMN HEADING	DESCRIPTION	FORMAT	COMMENTS
OBS	Observation 1 (with MAREA=" ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric	
MAREA	Identifier in the dataset for area	Text	
AGECAT	Age stratification category	Numeric range	
SEXCAT	Gender stratification category	Numeric	
PAYCAT	Payer stratification category	Numeric	
RACECAT	Race stratification category	Numeric	
TAPDnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric	
PAPDnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric	
OAPDnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric	
RAPDnn	The estimated rate calculated by adjusting to an "average" case mix	Numeric	When stratifications other than hospital or area are selected, the RAPDnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables
SAPDnn	The smoothed rate calculated as a weighted average of the risk-adjusted and reference population rates	Numeric	

Table 32. SAS PQI Area Output

COLUMN HEADING	DESCRIPTION	FORMAT	COMMENTS
OBS	Observation 1 (with MAREA=" ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric	
MAREA	Identifier in the dataset for area	Text	
TAPQnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric	
PAPQnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric	
OAPQnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric	
RAPQnn	The estimated rate calculated by adjusting to an "average" case mix	Numeric	When stratifications other than hospital or area are selected, the RAPQnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables
LAPQnn	The lower confidence bound of the risk-adjusted rate	Numeric	
UAPQnn	The upper confidence bound of the risk-adjusted rate	Numeric	
SAPQnn	The smoothed rate calculated using multivariate signal extraction	Numeric	
XAPQnn	Standard error of smoothed rate	Numeric	
EAPQnn	Rate calculated by assuming an "average" performance for each patient group based on the reference population but with the provider's actual case mix	Numeric	

Table 33. SAS PSI Provider Output

COLUMN HEADING	DESCRIPTION	FORMAT	COMMENTS
OBS	Observation 1 (with HOSPID="." or " ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric	
HOSPID	Identifier for each provider in the dataset	Text or numeric	Depends on format of HOSPID in source dataset
AGECAT	Age stratification category	Numeric range	
SEXCAT	Gender stratification category	Numeric	1=male 2=female
PAYCAT	Payer stratification category	Numeric	1=Medicare 2=Medicaid 3=private, including HMO 4=self-pay 5=no charge 6=other
RACECAT	Race stratification category	Numeric	1=White 2=Black 3=Hispanic 4=Asian or Pacific Islander 5=Native American 6=other
TPPSnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric	
PPPSnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric	
OPPSnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric	
EPPSnn	Rate calculated by assuming an "average" performance for each patient group based on the reference population but with the provider's actual case mix	Numeric	
RPPSnn	The estimated rate calculated by adjusting to an "average" case mix	Numeric	When stratifications other than hospital or area are selected, the RPPSnn variables and their confidence intervals are observed/expected ratios to avoid confounding with risk adjustment variables
LPPSnn	The lower confidence bound of the risk-adjusted rate	Numeric	
UPPSnn	The upper confidence bound of the risk-adjusted rate	Numeric	
SPPSnn	The smoothed rate calculated using multivariate signal extraction	Numeric	
XPPSnn	Standard error of smoothed rate	Numeric	
VPPSnn	Variance for respective indicators	Numeric	

HMO: health maintenance organization

Table 34. SAS PSI Area Output

COLUMN HEADING	DESCRIPTION	FORMAT
OBS	Observation 1 (with MAREA=" ") is the overall average for the entire dataset (TYPELVLP=0). The remaining observations are individual providers, or hospitals (TYPELVLP=16).	Numeric
MAREA	Identifier in the dataset for area	Text
TAPSnn	The number of discharge records included in the numerator (outcome of interest) as defined for the indicator	Numeric
PAPSnn	The number of discharge records included in the denominator (population at risk) as defined for the indicator	Numeric
OAPSnn	The rate (observed numerator/observed denominator) as defined for the indicator	Numeric

Appendix E: Provider-Level and Area-Level Indicators

Table 35. List of Provider-Level Indicators

INDICATOR NAME
IQI 01 Esophageal Resection Volume
IQI 02 Pancreatic Resection Volume
IQI 04 Abdominal Aortic Aneurysm (AAA) Repair Volume
IQI 05 Coronary Artery Bypass Graft (CABG) Volume
IQI 06 Percutaneous Coronary Intervention (PCI) Volume
IQI 07 Carotid Endarterectomy Volume
IQI 08 Esophageal Resection Mortality Rate
IQI 09 Pancreatic Resection Mortality Rate
IQI 11 Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate
IQI 12 Coronary Artery Bypass Graft (CABG) Mortality Rate
IQI 13 Craniotomy Mortality Rate
IQI 14 Hip Replacement Mortality Rate
IQI 15 Acute Myocardial Infarction (AMI) Mortality Rate
IQI 16 Heart Failure Mortality Rate
IQI 17 Acute Stroke Mortality Rate
IQI 18 Gastrointestinal Hemorrhage Mortality Rate
IQI 19 Hip Fracture Mortality Rate
IQI 20 Pneumonia Mortality Rate
IQI 21 Cesarean Delivery Rate, Uncomplicated
IQI 22 Vaginal Birth After Cesarean (VBAC) Delivery Rate, Uncomplicated
IQI 23 Laparoscopic Cholecystectomy Rate
IQI 24 Incidental Appendectomy in the Elderly Rate
IQI 25 Bilateral Cardiac Catheterization Rate
IQI 30 Percutaneous Coronary Intervention (PCI) Mortality Rate
IQI 31 Carotid Endarterectomy Mortality Rate
IQI 32 Acute Myocardial Infarction (AMI) Mortality Rate, Without Transfer Cases
IQI 33 Primary Cesarean Delivery Rate, Uncomplicated
IQI 34 Vaginal Birth After Cesarean (VBAC) Rate, All
IQI 90 Mortality for Selected Procedures
IQI 91 Mortality for Selected Conditions
NQI 01 Neonatal Iatrogenic Pneumothorax Rate
NQI 02 Neonatal Mortality Rate
NQI 03 Neonatal Blood Stream Infection Rate
PDI 01 Accidental Puncture or Laceration Rate
PDI 02 Pressure Ulcer Rate
PDI 03 Retained Surgical Item or Unretrieved Device Fragment Count

INDICATOR NAME
PDI 05 Iatrogenic Pneumothorax Rate
PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate
PDI 07 RACHS-1 Pediatric Heart Surgery Volume
PDI 08 Perioperative Hemorrhage or Hematoma Rate
PDI 09 Postoperative Respiratory Failure Rate
PDI 10 Postoperative Sepsis Rate
PDI 11 Postoperative Wound Dehiscence Rate
PDI 12 Central Venous Catheter-Related Blood Stream Infection Rate
PDI 13 Transfusion Reaction Count
PDI 19 Pediatric Patient Safety for Selected Indicators
PSI 02 Death Rate in Low-Mortality Diagnosis Related Groups (DRGs)
PSI 03 Pressure Ulcer Rate
PSI 04 Death Rate among Surgical Inpatients with Serious Treatable Complications
PSI 05 Retained Surgical Item or Unretrieved Device Fragment Count
PSI 06 Iatrogenic Pneumothorax Rate
PSI 07 Central Venous Catheter-Related Blood Stream Infection Rate
PSI 08 Postoperative Hip Fracture Rate
PSI 09 Perioperative Hemorrhage or Hematoma Rate
PSI 10 Postoperative Physiologic and Metabolic Derangement Rate
PSI 11 Postoperative Respiratory Failure Rate
PSI 12 Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate
PSI 13 Postoperative Sepsis Rate
PSI 14 Postoperative Wound Dehiscence Rate
PSI 15 Accidental Puncture or Laceration Rate
PSI 16 Transfusion Reaction Count
PSI 17 Birth Trauma Rate – Injury to Neonate
PSI 18 Obstetric Trauma Rate – Vaginal Delivery With Instrument
PSI 19 Obstetric Trauma Rate – Vaginal Delivery Without Instrument
PSI 90 Patient Safety for Selected Indicators

IQI: Inpatient Quality Indicator; NQI: Neonatal Quality Indicator; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; PSI: Patient Safety Indicator

Table 36. List of Area-Level Indicators

INDICATOR NAME
IQI 26 Coronary Artery Bypass Graft (CABG) Rate
IQI 27 Percutaneous Coronary Intervention (PCI) Rate
IQI 28 Hysterectomy Rate
IQI 29 Laminectomy or Spinal Fusion Rate
PDI 14 Asthma Admission Rate
PDI 15 Diabetes Short-Term Complications Admission Rate
PDI 16 Gastroenteritis Admission Rate
PDI 17 Perforated Appendix Admission Rate
PDI 18 Urinary Tract Infection Admission Rate
PDI 90 Pediatric Quality Overall Composite
PDI 91 Pediatric Quality Acute Composite
PDI 92 Pediatric Quality Chronic Composite
PQI 01 Diabetes Short-Term Complications Admission Rate
PQI 02 Perforated Appendix Admission Rate*
PQI 03 Diabetes Long-Term Complications Admission Rate
PQI 05 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate
PQI 07 Hypertension Admission Rate
PQI 08 Heart Failure Admission Rate
PQI 09 Low Birth Weight Rate
PQI 10 Dehydration Admission Rate
PQI 11 Bacterial Pneumonia Admission Rate
PQI 12 Urinary Tract Infection Admission Rate
PQI 13 Angina Without Procedure Admission Rate
PQI 14 Uncontrolled Diabetes Admission Rate
PQI 15 Asthma in Younger Adults Admission Rate
PQI 16 Lower-Extremity Amputation among Patients with Diabetes Rate
PQI 90 Prevention Quality Overall Composite
PQI 91 Prevention Quality Acute Composite
PQI 92 Prevention Quality Chronic Composite
PSI 21 Retained Surgical Item or Unretrieved Device Fragment Rate
PSI 22 Iatrogenic Pneumothorax Rate
PSI 23 Central Venous Catheter-Related Blood Stream Infection Rate
PSI 24 Postoperative Wound Dehiscence Rate
PSI 25 Accidental Puncture or Laceration Rate
PSI 26 Transfusion Reaction Rate
PSI 27 Perioperative Hemorrhage or Hematoma Rate

*The denominator for PDI 17 includes all hospital admissions for appendicitis in the area.
IQI: Inpatient Quality Indicator; PDI: Pediatric Quality Indicator; PQI: Prevention Quality Indicator; PSI: Patient Safety Indicator