

Measuring Nursing Home Quality – The Five-Star Rating System

Christianna Williams¹, Louise Hadden², Edward Mortimore³, Frank Nagy³,
Michael Plotzke², and Alan White⁴

¹Independent Consultant, Chapel Hill, NC

²Abt Associates Inc., Cambridge, MA

³Centers for Medicare and Medicaid Services, Baltimore, MD

⁴Abt Associates Inc., Durham, NC

ABSTRACT

Since 1998, the U.S. Centers for Medicare and Medicaid Services (CMS) has maintained a website, Nursing Home Compare, which provides detailed quality information about every certified nursing home in the country. In December 2008, CMS greatly enhanced the usability of the website by adding an easy-to-understand 5-star rating. Each nursing home receives one to five stars based on performance in each of three key quality domains (health inspections, reported staffing levels, and quality measures derived from mandated assessments of resident health and well-being) plus an overall quality rating. Calculation of ratings requires integration of information from both facility and resident-level data sources. SAS® was used extensively in analysis to support the development of the rating system, and it is currently used to process data to refresh the ratings each month, based on newly collected data in each domain. This presentation describes the integration of data from various sources and the rating algorithms, as well as some of the decisions that were made in the design of the ratings. The presentation also describes how the “5-star team” maintains a consistent process as the rating methodology is refined, and new data are received monthly.

INTRODUCTION

More than 3 million Americans live in nursing homes in the United States. In 2008, just over 7 percent of the over-65 population and more than 20 percent of the over-85 population had a nursing home stay (CMS, 2009). Many of these are long-term nursing home residents, but an increasing proportion are short-stay or post-acute patients, who spend time in a nursing home for rehabilitation after an acute hospitalization, before returning to the community. While few would dispute that the quality of nursing home care has increased markedly since the passage of the Nursing Home Reform Act in 1987, quality of care remains an important concern. Over the past several years, there has been an increased emphasis on providing information to consumers about the performance of medical providers, including nursing homes, to assist them in making choices about providers, including nursing homes. This type of public reporting is intended to improve quality of care by motivating improvements in the quality of individual providers and by increasing the likelihood that patients choose high-quality providers.

Nursing Home Compare (<http://www.medicare.gov/NHCompare>) is one of several “Compare” Websites maintained by the US Department of Health and Human Services to provide information to consumers about individual providers. Since its inception in 1998, Nursing Home Compare has provided an increasing amount of detailed information about nursing home quality. Indeed, the amount of information provided and the way in which the information has been presented may have been somewhat overwhelming and difficult to interpret and synthesize for many prospective nursing home residents and their families. Thus, the Centers for Medicare and Medicaid Services (CMS), which is responsible for the certification and licensure of all nursing homes in the US that receive Medicare and/or Medicaid reimbursement for services, as well as for the content and layout of Nursing Home Compare, decided to make a major change in the way information about nursing homes is displayed on the website. Specifically, they decided to construct summary ratings of nursing home quality using the data already available on the website. The summary ratings are displayed as easily understandable star ratings. Each home is given a 1 to 5 star rating on three distinct domains of quality, as well as an overall rating. CMS first reported these ratings on the Nursing Home Compare website in December 2008 and updates them each month as new data become available. Additionally, CMS carries on several related activities to support the use of the website, both by providers and consumers. For example, each month, an individualized “Provider Preview” report is generated for every nursing home and distributed to providers’ electronic mailboxes so that they can see their ratings in advance of the release of this information to the public via the website. Additionally, CMS operates a telephone “Helpline”, used primarily by providers, to address questions related to the ratings and the underlying data.

The remainder of this paper illustrates the rating system on Nursing Home Compare and describes the development of the rating system, including discussion of each of the quality domains; the data processing used to produce the ratings each month; and some of the additional programming and analysis that is done for quality assurance, ongoing review and reporting. SAS has been used extensively throughout the process – for analysis to support the development of the rating algorithms, for the processing of the data each month to generate the ratings, and for producing several different types of reports that are used by providers, state survey agencies and by CMS.

A QUICK LOOK AT THE WEBSITE

Figure 1 shows the home page for Nursing Home Compare. The page gives an overview of how to use the website and how to go about choosing a nursing home. On the right-hand side are several links that give additional information about the data displayed on the site, including the five-star rating.

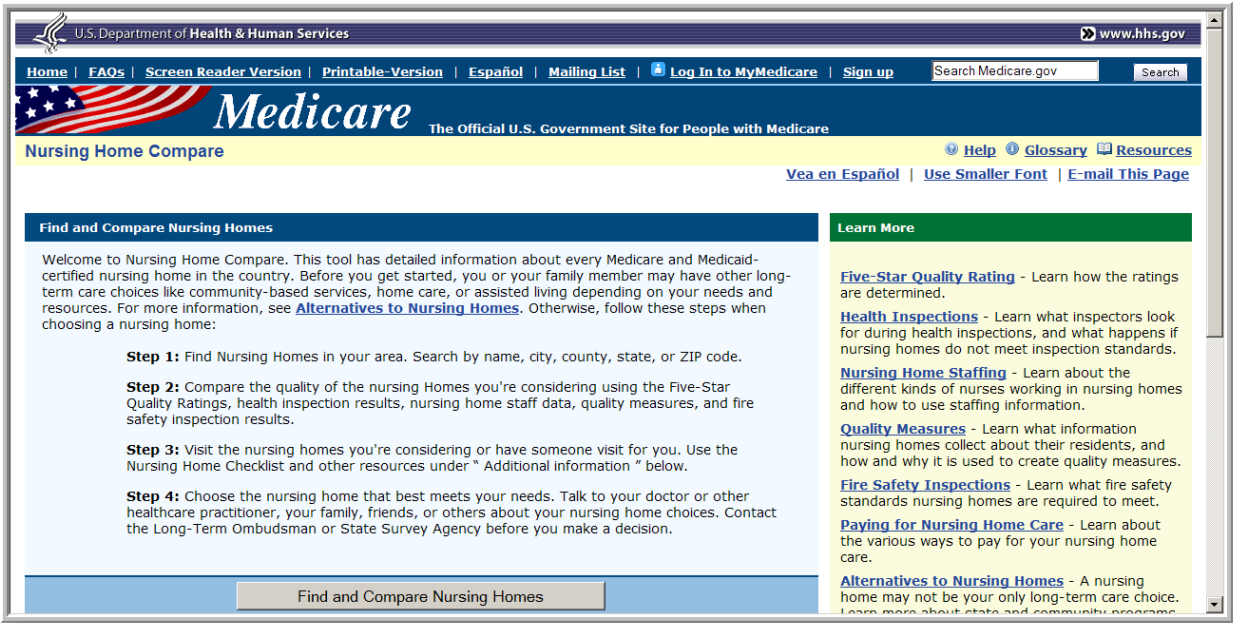


Figure 1. Home page for Nursing Home Compare website

If you click on the “Find and Compare Nursing Homes” button near the bottom of the page, it brings you to a page with several options for searching, shown in Figure 2.

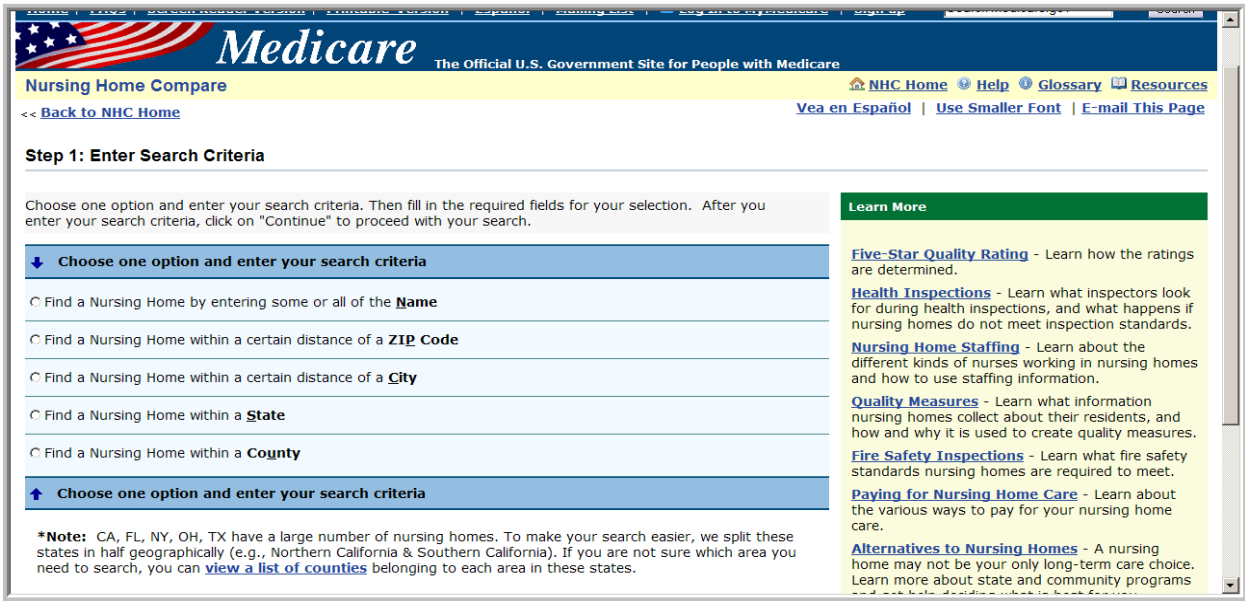


Figure 2. Step 1: Enter Search Criteria

Let's say we want to find a nursing home in Seattle, Washington. We could click on the radio button for “Find a Nursing Home within a certain distance of a City”, and a small form would open where we could enter the search criteria. If we said we wanted to find nursing homes within Seattle, we'd then come to a page telling us that there are 32 nursing homes in Seattle, Washington, and if we scroll down we'd see rating information for each. Figure 3 shows a subset of these facilities.

Information [View Nursing Home Locations on a map](#) [What is this?](#)

Choose up to 3 nursing homes to Sort Table By:

	Nursing Home Name and General Information ▲	Overall Rating	Health Inspections	Nursing Home Staffing	Quality Measures	Program Participation	Number of Certified Beds	Type of Ownership
		(What is this?)	(What is this?)	(What is this?)	(What is this?)			
☐	ANDERSON HOUSE 17127 15TH AVENUE NORTHEAST SEATTLE, WA 98155 (206) 364-7131 Resident Council Mapping & Directions	☆☆☆ 3 out of 5 stars	☆☆☆☆ 4 out of 5 stars	☆☆☆☆ 4 out of 5 stars	★ 1 out of 5 stars	Medicare and Medicaid	85	For profit - Partnership
☐	ARDEN REHABILITATION & HEALTHCARE CENTER 16357 AURORA AVENUE NORTH SEATTLE, WA 98133 (206) 542-3103 Resident & Family Councils Mapping & Directions	★ 1 out of 5 stars	★ 1 out of 5 stars	☆☆☆ 3 out of 5 stars	☆☆☆ 3 out of 5 stars	Medicare and Medicaid	90	For profit - Corporation
☐	BAILEY-BOUSHAY HOUSE 2720 EAST MADISON SEATTLE, WA 98112 (206) 322-5300 Resident Council	☆☆☆☆ 4 out of 5 stars	☆☆☆☆ 4 out of 5 stars	☆☆☆☆☆ 5 out of 5 stars	★ 1 out of 5 stars	Medicare and Medicaid	35	Non profit - Corporation

Figure 3. Overview display for three nursing homes in Seattle, WA

The list is initially sorted alphabetically, but it can be sorted in several other ways, including by any of the columns shown. Additionally, if you click on any of the facility names, you “drill-down” to additional information, including specific details about what underlies each of the ratings, and information about how this compares to other nursing homes in the same state and also the entire country. Much of this detailed data has been available on the website for many years, but the new five-star rating helps consumers to interpret it.

DEVELOPMENT OF RATING SYSTEM

From the outset of developing the 5-star rating system, CMS had several key principles in mind. These included:

- Use data that was already available on Nursing Home Compare for the basis of the ratings, but take those individual bits of information and combine and scale them in such a way to provide empirically derived relative ratings that consumers can easily understand.
- Incorporate multiple dimensions of quality. Specifically, base ratings on information derived from three sources:
 - o Health Inspections – derived from federally mandated on-site inspections by trained surveyors, occurring in all licensed nursing homes approximately once a year;
 - o Staffing Levels – reported by nursing homes at the time of their annual health inspection and to be expressed as hours of nursing care per resident per day, adjusted for nursing home case-mix.
 - o Quality Measures – indicators regarding specific aspects of resident care and well-being, such as nutrition, mobility and pain, derived from federally mandated assessments of individual residents.
- Solicit input from experts in the field of nursing home quality, familiar with the strengths and limitations of the available data, as to how best to use these data to derive empirically sound, justifiable and interpretable ratings. For example, three features of the rating system strongly endorsed by these technical experts were:
 - o To have separate ratings for each of the three dimensions of quality. The experts felt this would give consumers additional important information and that the dimensions are not necessarily correlated with one another.
 - o Weight the health inspections domain more heavily than the staffing or quality measures domains in determining nursing home’s overall rating.
 - o To have fewer 5-star facilities than 1-star facilities. The experts felt that there are fewer truly outstanding nursing homes than there are ones that are well-below average.
- Wherever possible, use an evidence base for assigning thresholds for star ratings. Where there is no evidence base for particular cutpoints, use the distribution of the data to determine boundaries between rating levels.

- Provide detailed technical explanation of how the ratings are derived so that providers understand why their rating is what it is and what they need to change to improve the rating.
- Emphasize that these ratings should be only one part of the information that consumers use in choosing a nursing home, and that they should not replace personal visits to homes and ongoing conversations with nursing home staff. As Acting Administrator of CMS, Kerry Weems said, "While Nursing Home Compare is very informative, it is important to note that this should be just one of the tools that family members and caregivers use in the selection of a nursing home. There is no substitute for visiting a nursing home in person and meeting with staff, residents, and other families."¹

RATING DOMAINS

This section provides some background on each of the three rating domains – health inspections, staffing and quality measures. The next section describes how these data are used to construct the 5-star ratings.

HEALTH INSPECTIONS

To be part of the Medicare and Medicaid programs, nursing homes have to meet certain requirements set by Congress. CMS has entered into an agreement with state governments to do health inspections and fire safety inspections of these nursing homes and investigate complaints about nursing home care. Certified nursing homes must meet over 180 regulatory standards designed to protect nursing home residents. These standards cover a wide range of topics, from proper management of medications, protecting residents from physical or mental abuse and inadequate care, to the safe storage and preparation of food. The health inspection team consists of trained inspectors, including at least one registered nurse. These inspections take place, on average, about once a year, but may be done more often if the nursing home is performing poorly. Using the regulatory standards, the state inspection team looks at many aspects of life in the nursing home including the care of residents and the processes used to give that care, how the staff and residents interact, and various aspects of the nursing home environment. In addition, inspectors review the residents' clinical records, interview some residents and family members about their life at the nursing home, and interview caregivers and administrative staff.

When an inspection team finds that a nursing home doesn't meet a specific standard, it issues a deficiency citation. In addition to identifying the type of problem (e.g. food safety, infection control, or level of professional services), the deficiency is rated with respect to its severity (immediate jeopardy to resident health or safety, actual harm that is not immediate jeopardy, no actual harm but potential for more than minimal harm, no actual harm and potential for no more than minimal harm) and scope (isolated, pattern, widespread). These citations can trigger a wide range of enforcement actions by CMS, commensurate with the scope and severity, and require a plan of correction by the nursing home. States record all the information they find during an inspection in the detailed inspection report (form HCFA-2567), which includes codes for the type(s) of deficiencies identified as well as a code indicating scope and severity.

CMS wanted the health inspection domain to play a predominant role in determining the overall 5-star rating. The main reason for this is that, unlike the staffing and quality measure domains, which are based on data self-reported by nursing homes, independent surveyors carry out the health inspection; thus, the data should be more objective and unbiased.

QUALITY MEASURES

Nursing homes are required to regularly collect assessment information on all their residents using a form called the Minimum Data Set (MDS). The information collected includes the residents' health, physical functioning, mental status, and general well being. Nursing homes self-report this information to Medicare. Medicare uses some of the assessment information to measure the quality of certain aspects of nursing home care, like whether residents have gotten their flu shots, are in pain, or are losing weight. These measures of care are called "quality measures" (QMs); all are expressed as percentages. Medicare posts each nursing home's scores for nineteen QMs on Nursing Home Compare – such as the percentage of residents who were physically restrained (where a lower percentage indicates better care). Some of the measures apply only to long-stay residents and others apply only to short-stay or post-acute residents. CMS selected ten measures (including seven long-stay measures and three short-stay measures) to incorporate into the 5-star rating choosing from those considered by experts in the field to be the most important indicators of quality and those that are the most valid measures. Some of the measures are adjusted for resident acuity with a regression-based method, and others control for case-mix by stratification (such as the percentage of high-risk residents with pressure ulcers or bedsores).

The QMs are based on information self-reported by the nursing homes. While they cover important aspects of care and are resident-focused, they are not as comprehensive as the health inspections. For these reasons, CMS chose to give less weight to the QMs in the overall rating than the health inspection domain.

¹ CMS Press Release, June 18, 2008 – "CMS to Rate Nursing Home Quality – New Five-Star System To Be Added to Nursing Home Compare Site"

STAFFING

There is strong evidence of a relationship between nursing home staffing levels, staffing stability, and resident outcomes. A CMS study (Fish and Kramer, 2001) found a clear association between nurse staffing ratios and nursing home quality of care, identifying specific ratios of staff to residents below which residents are at substantially higher risk of quality problems.

Each nursing home reports its staffing hours to its state survey agency. Staffing is reported separately for different types of staff, including registered nurses (RNs), licensed nurses, and certified nursing assistants. These staffing hours cover the two-week period just before the health inspection and are reported in a standardized format (CMS form 671) via a system called Online Survey Certification and Reporting (OSCAR). The staffing hours reported by the nursing home are converted into measures of staff hours per resident per day, using the resident census (number of residents living in the nursing home) at the time of the survey.

CMS performs some checks on the data to identify data problems, applying a set of exclusion criteria to identify facilities with unreliable staffing or resident census data, and neither staffing data nor a staffing rating are reported for these facilities. While the exclusion criteria identify facilities with obvious data problems, there currently is no system to fully verify the accuracy of the staffing data that nursing homes report. For this reason, and because the staffing data only cover a two-week period, staffing is less important than health inspections in determining nursing home's overall rating.

In the 5-star rating system, reported staffing levels are adjusted for the level of acuity (case-mix) of the residents in the nursing home, to account for the fact that facilities with sicker, frailer residents need higher levels of staffing to provide adequate care. The adjustment is based on the case-mix system that CMS uses in its prospective payment for Medicare-covered nursing home stays. On a quarterly basis, MDS data are used to estimate the "expected" staff time for a facility based on the distribution of residents in the 53 payment groups in the case-mix system. This data is then used to adjust the reported staffing levels according to the following formula:

$$\text{Hours}_{\text{Adjusted}} = (\text{Hours}_{\text{Reported}} / \text{Hours}_{\text{Expected}}) * \text{Hours}_{\text{National Average}}$$

where $\text{Hours}_{\text{National Average}}$ is the mean across all facilities of the reported hours per resident day for a given staff type. When a nursing home's reported staffing exceeds its expected staffing, the adjusted staffing will be higher than the national average; conversely, if its reported staffing is lower than its expected staffing, its adjusted staffing will be lower than the national average. This allows the staffing values to be placed on a comparable scale for all the nation's nursing homes.

The 5-star rating for staffing is based on two case-mix adjusted measures: Total nursing hours per resident day (RN+licensed nurse+nurse aide hours) and RN hours per resident day. That RN staffing is "double-counted" is intentional, in recognition of the central importance of RNs in the provision of quality care for nursing home residents.

SCORING

This section describes how the data from each domain are aggregated and scored to generate the 5-star rating.

HEALTH INSPECTIONS SCORING

For the purpose of the 5-star rating system, each deficiency is scored with a certain point value, with more points for more severe and more widespread problems. Additionally, if someone (resident, family member or staff member) files a complaint against a nursing home, this may trigger an investigation by the state survey agency. If the complaint is substantiated, it will result in one or more deficiency citations, which are scored in the same way as deficiencies identified during the standard health inspection process. However, the same deficiency will not be scored twice from a standard health inspection and complaint investigation if they occur within one month of each other. Finally, when serious deficiencies are found during the health inspection, a revisit is often scheduled to determine if the problem has been rectified. In rare instances, multiple revisits are required to ensure correction of the problem; when this happens, a non-compliance penalty is assigned, with points proportional to the original deficiency score. Additional points are added if three or four revisits occur.

Standard health inspections generally take place once a year. To compute the 5-star rating, three cycles of health inspection data are used, with the more recent data weighted more heavily. While CMS does provide federal oversight of the survey process, there is substantial state-to-state variation in how the process is carried out. Additionally, state variation in licensing requirements and in Medicaid programs (which pay for much of nursing home care) leads to substantial variation among states in the number of deficiencies that are cited. As a result, ratings are assigned on a state-by-state basis for this domain. Once the total scores are assigned to all facilities within each state, based on three years of health inspections, complaint citations and multiple revisits, a star rating is assigned so that:

- The top 10% of facilities within a state (lowest scores) receive 5 stars;
- The lowest 20% of facilities within a state (highest scores) receive 1 star;

- The remaining 70% are equally divided and receive 2, 3 or 4 stars.

Because surveys occur on a rolling basis and complaints can occur at any time, the thresholds dividing the star ratings are re-assigned every month, with the proviso that if a given facility has no new data that its star rating will not change.

QUALITY MEASURE RATING

Ratings for the QM domain are calculated using the three most recent quarters for which data are available. The adjusted three-quarter QM values for each of the 10 QMs used in the 5-star rating are computed as follows:

$$QM_{3Quarter} = [(QM_{Q1} * D_{Q1}) + (QM_{Q2} * D_{Q2}) + (QM_{Q3} * D_{Q3})] / (D_{Q1} + D_{Q2} + D_{Q3})$$

Where QM_{Q1} , QM_{Q2} , and QM_{Q3} correspond to the adjusted QM values (percentages) for the three most recent quarters and D_{Q1} , D_{Q2} , and D_{Q3} are the denominators (number of eligible residents for the particular QM) for the same three quarters.

For each of the 10 QMs, points are assigned to nursing homes based on the distribution of the measure, with each divided into quintiles. These points are summed across the 10 QMs; two measures based on resident functional status and mobility – considered by the technical experts to be of greater importance with respect to quality of resident care are given extra weight. This summative score is then converted to a 1 to 5 star rating in much the same way as the health inspection domain, with the top 10 percent of facilities receiving 5 stars, the bottom 20 percent receiving 1 star and the remaining 70 percent equally divided among 2, 3 and 4 stars. Distinct from the health inspection domain, the thresholds are set nationally, and do not change from month to month. The rationale for this is that there is much less interstate variation in the QMs.

STAFFING RATING

As noted above, the staffing rating is based on adjusted RN staffing levels and adjusted total staffing levels. The two staffing measures are given equal weight. For each of RN staffing and total staffing, a 1 to 5 rating is assigned based on a combination of the percentile-based method and staffing thresholds identified in the CMS staffing study.² For each facility, a total staffing score is assigned based on the combination of the two staffing ratings. The percentile thresholds (data boundaries between each star category) were determined using the data available as of December 2008. The advantage of fixed cut-points is that it better tracks facility improvement (or decline) over time. Nursing homes that seek to improve their staffing, for example, can ascertain the increased levels at which they would be afforded a higher star rating for the staffing domain, given stable case-mix. In fact, there is some evidence that staffing levels have increased slightly since the institution of the 5-star rating.

OVERALL QUALITY RATING

The three individual rating domains are then combined to produce a single overall rating. The overall rating is based primarily on the health inspection rating for the reasons described above. The general algorithm is as follows²:

Step 1: Start with the health inspection five-star rating.

Step 2: Add one star to the Step 1 result if staffing rating is four or five stars and greater than the health inspection rating; subtract one star if staffing is one star. The overall rating cannot be more than five stars or less than one star.

Step 3: Add one star to the Step 2 result if quality measure rating is five stars; subtract one star if quality measure rating is one star. The overall rating cannot be more than five stars or less than one star.

Step 4: If the Health Inspection rating is one star, then the Overall Quality rating cannot be upgraded by more than one star based on the Staffing and Quality Measure ratings.

The rationale for upgrading facilities in Step 2 that receive either a four- or five-star rating for staffing (rather than limiting the upgrade to those with five stars) is that the criteria for the staffing rating is quite stringent. To earn four stars on the staffing measure, a facility must meet or exceed the CMS staffing study thresholds for RN or total staffing; to earn five stars on the staffing measure, a facility must meet or exceed the CMS staffing study thresholds for both RN and total staffing. However, requiring that the staffing rating be greater than the health inspection rating in order for the score to be upgraded ensures that a facility with four stars on health inspections and four stars on staffing (and more than one star on QMs) does not receive a five-star overall rating.

The rationale for limiting upgrades in Step 4 is that two self-reported data domains should not significantly outweigh the rating from actual onsite visits from trained surveyors who have found very serious quality of care problems. And since the health inspection rating is heavily weighted toward the most recent findings, a one-star health rating reflects both a serious and recent finding.

² One additional rule governs the assignment of the overall rating. If a facility has been denoted by CMS as a "Special Focus Facility" due to repeated poor performance on health inspections, it can not receive higher than an overall 3-star rating. However, because of the predominance of the health inspection rating in the overall rating, this "override" rule is almost never invoked.

The method for determining the overall nursing home rating does not assign specific weights to the survey, staffing, and QM domains. The Health Inspection rating is the most important dimension in determining the overall rating, but, depending on their performance on the staffing and QM domains, a facility's overall rating may be up to two stars higher or lower than their Health Inspection rating.

DATA PROCESSING

This section provides an overview of the way in which data flows from the thousands of US nursing homes, the state and regional offices into the CMS central office and then is extracted for Five-Star. We then briefly describe the monthly data processing by Abt to turn the raw data extracts from the national data base into the publicly reported ratings.

DATA FLOW

Figure 4 provides a graphical depiction of the flow of data from initial point of collection to ultimate posting on that Nursing Home Compare. Note that the databases portrayed in this figure are used for many other purposes by CMS – both centrally and at regional and state offices; this figure focuses on the pieces relevant to production of the Five-Star ratings.

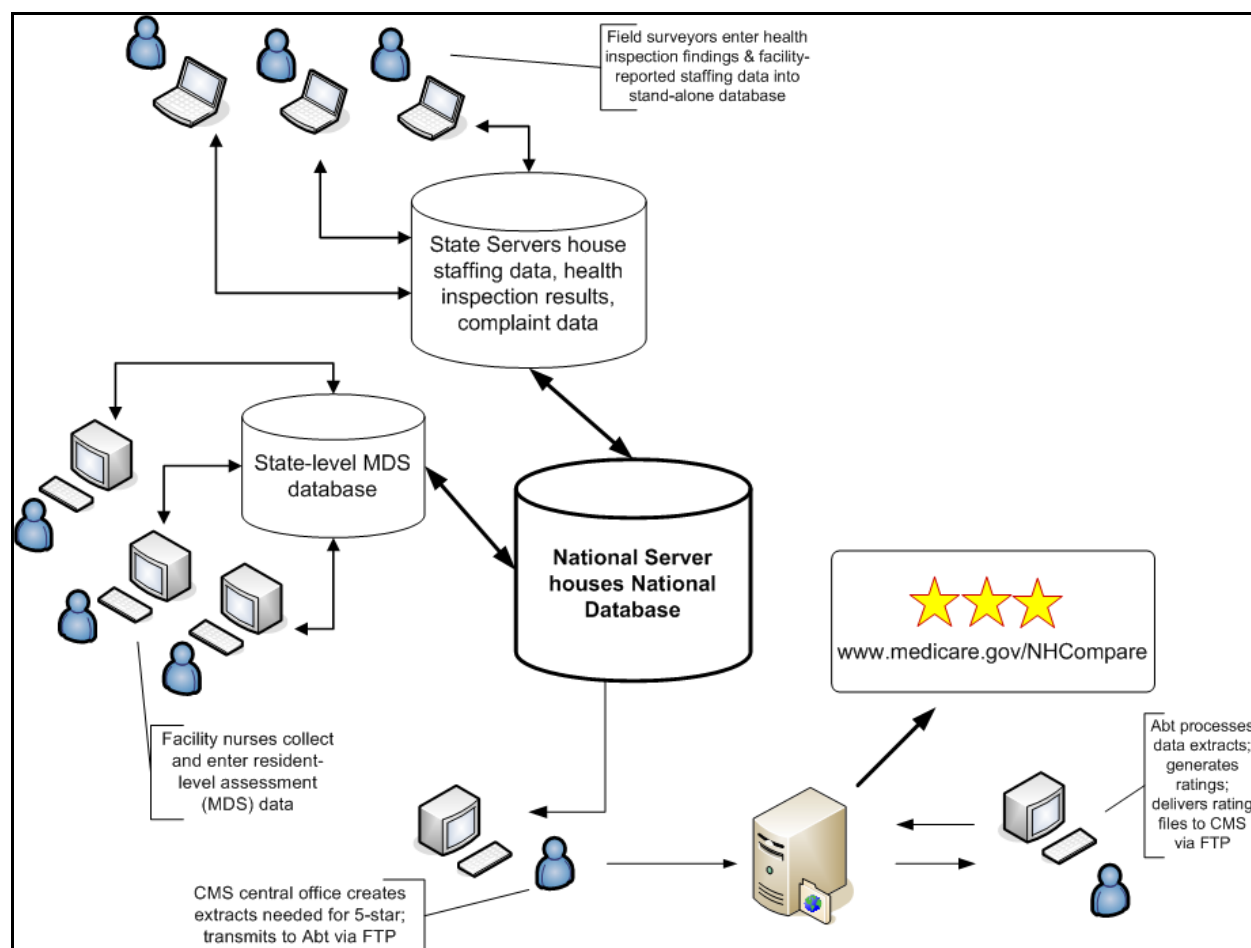


Figure 4. Data Flow Process for Generation of 5-Star Ratings for Nursing Home Compare

GENERATION OF RATINGS

Each month, on or near the first business day of the month, CMS provides Abt with a standard set of data files that are used as the 'raw' data inputs for the generation of an updated set of ratings. Additional files are provided quarterly. The files are delivered via Abt's secure FTP server, to which key CMS and Abt staff have password-protected access for uploading and downloading files. Originally, these were provided as flat text files, but more recently they are SAS data sets. Files for the different domains are provided at different levels of aggregation. For example, the health inspection data files are at the level of the individual deficiency citation, with separate files for

each year of survey data, for complaint data and revisit information. The reported staffing data is facility-level but the case-mix information, provided quarterly, is resident-level. At the end of processing, all data will be facility-level, with records uniquely identified by the federal CMS-assigned provider ID.

Abt processes these files using a set of custom SAS® programs in order to implement the algorithms described in the prior section and calculate the new ratings, and delivers data files containing the ratings to CMS, again via the FTP server. After additional testing, CMS provides the rating files along with other files to be displayed on Nursing Home Compare to the contractor that maintains the website. In addition, Abt produces several other standard analytical reports based on the ratings and data files, used by CMS and others, to allow ad hoc analyses and to address queries from stakeholders. Among these monthly deliverables are a set of “Provider Previews” – individualized reports for each provider containing their updated ratings and explanatory text, distributed to all providers in advance of the monthly website update. These are described in more detail in the next section.

All SAS processing is done in “batch” mode so that a detailed log is generated. For example, the number of records in each data set is recorded at each step in the process. These logs are carefully reviewed to ensure that the results of each step are as expected. Output is checked at many intermediate steps within each program. An external log (Word document) is also created each month to record completion/review of each step and note any “hard code” data edits or anomalies in processing. When new versions of specific programs are developed for implementation of refinements they are also recorded in the monthly processing log. Each month the programmers use the previous month’s log as a guide for the current processing.

At the top of each SAS program is a detailed header portion (Comment), which lists the following:

- Program name (including version number)
- Program ancestor (prior version) if any
- Directory location
- Brief description of purpose of program
- Prior program (previous processing step)
- Names of all data sets that are used as inputs in the program
- Names of all permanent data sets that are generated by program
- Program creation date
- Dated notes of all edits or revisions to program including those that caused a version change.

Each month before running the program, the programmer will review the notes to see if any part of the processing should receive additional scrutiny (e.g. whether previous hard code edits still need to be made or whether new refinements are functioning as expected). The programmer will also check that all the needed input files are in place. Finally, at the top of each program are notes to the programmer indicating any edits that need to happen before running each month. In most cases, this is simply modifying two lines of SAS code that set macro variables for the year and date of the current month (included in most input and output data set names). For example, these statements refer to the February, 2010 round of processing:

```
%let filedate=022010;
%let fileyear=2010;
```

Note that we have considered setting these macro variables in a single master file so that they would have to be changed in only one place each month. Additionally, even further automation of the SAS processing would be possible (e.g. having one program call and run all subsequent steps). However, at this point, we have consciously decided not to further automate the process in order that the programmers maintain vigilance in reviewing each program, notes and log each month for any anomalies.

Any substantive change to a program leads to a new version number. This includes changes to the structure or name of input or output files or any change in the methodology due to refinement to the rating algorithms.

PROVIDER PREVIEW REPORTS

A preview of the month’s ratings in the form of a customized three-page PDF report is generated for each provider for each month. These reports are automatically loaded into providers’ e-mailboxes by means of specific identifying information embedded in the file name for each provider’s report. The data source for the reports is the Provider Rating file created at the conclusion of data processing for the month. Specific variables used in the customization of the reports are: State, Provider Number, Facility ID, Provider Name, Overall Rating, Health Inspection Rating, QM Rating, Staffing Rating, and RN Staffing Rating.

The report also contains information on the Helpline availability, which changes from month to month depending on which month in a quarter is being presented in the report. Thus, while much of the three page report is static, the ratings (in the form of one to five stars) and information on Helpline availability change from month to month. Helpline information is the same for all providers, while the ratings are provider-specific.

The PDF reports are automatically generated in a SAS program which contains a template for the static information

and empty “shells” for the provider number, provider state, name, facility id and rating information. This program is edited each month to change the report number and month being reported on (which are part of the PDF file name), and to update the Helpline availability information. The SAS program pulls in the CMS logo at the top, and displays ratings as one to five stars. PDF files are automatically named so as to conform to conventions used by IFMC to load files into providers’ electronic mailboxes. At the completion of the generation of approximately 15,700 PDF reports ranging from 158KB to 211KB in size for each provider in the country, the SAS program then compresses or “zips” the PDF files into a single zip archive approximately 3.1GB in size for transfer using WINZIP and the WINZIP command line interface. The zip archive is then encrypted and loaded to the Abt Secure FTP server for transfer to CMS.

A portion of a preview report – for a high-performing nursing home in Seattle, WA – is shown in Figure 5.

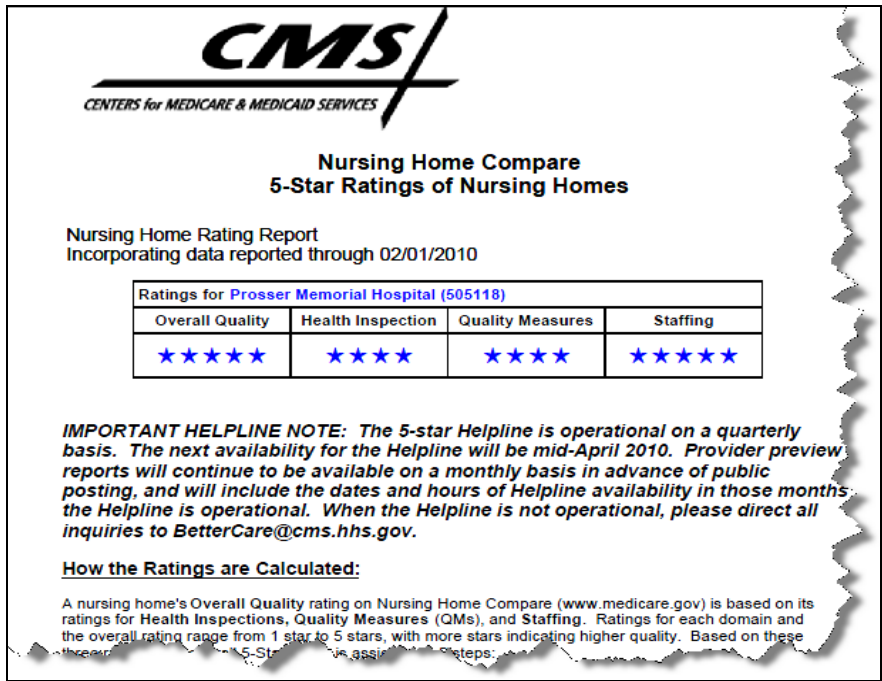


Figure 5. Portion of a single Provider Preview Report, for highly rated nursing home in Seattle, Washington

ANALYTIC RESULTS

Monthly analytic reports are generated for CMS, examining the distribution of the ratings, overall and broken down by facility characteristics of interest, such as size or profit/non-profit status. We also examine month-to-month and longer term trends in the ratings to identify change over time as well as possible data anomalies. Table 1 shows the overall distribution of the 5-star ratings for all US Nursing Homes, as posted on the website for February 2010.

Table 1. Distribution of Overall Rating and Ratings in Each Domain, All US Nursing Homes (N=15, 548)^a

5-star Measure	★	★★	★★★	★★★★	★★★★★
	N (%)	N (%)	N (%)	N (%)	N (%)
Overall	3,005 (19.3)	3,172 (20.4)	3,306 (21.3)	3,974 (25.6)	2,091 (13.4)
Health Inspections	3,029 (19.5)	3,652 (23.5)	3,579 (23.0)	3,649 (23.5)	1,639 (10.5)
MDS Quality Measures	2,295 (14.8)	3,169 (20.5)	3,759 (24.3)	4,338 (28.0)	1,912 (12.4)
Staffing	2,785 (18.4)	2,844 (18.8)	3,130 (20.7)	5,211 (34.4)	1,171 (7.7)

^aN=Number of facilities, excludes those too new to rate or with no data available; incorporates data reported to CMS through February 1, 2010.

Figure 6 shows the distribution of the overall ratings for January – December 2009. Because the distribution of the health inspection rating is essentially fixed by design, the distribution was relatively constant. However, due to increases in reported staffing and improvements in QM values, there has been a slight increase in the number of 4 and 5 star facilities and a decline in the proportion of 1-star facilities since the public reporting of the ratings began in December 2008. The distribution of the QM ratings for the same period is shown in Figure 7.

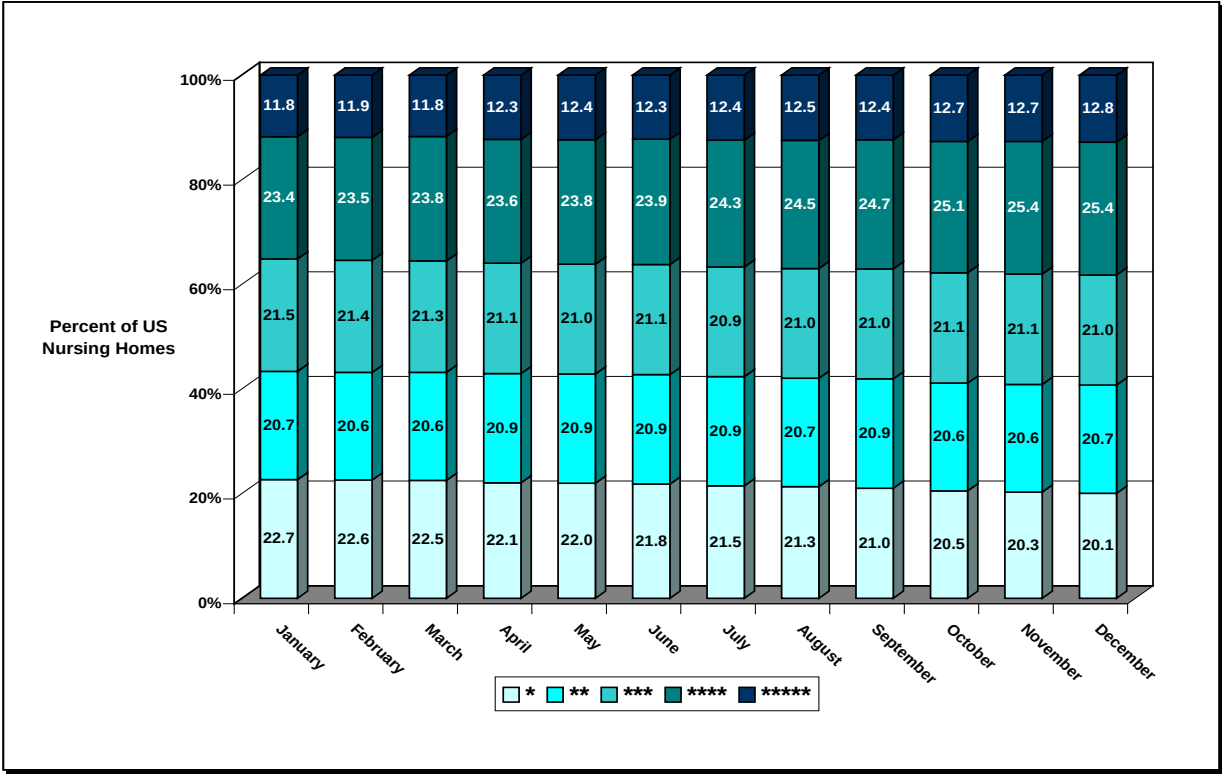


Figure 6. Distribution of Overall Quality Ratings, All US Nursing Homes (January - December 2009)

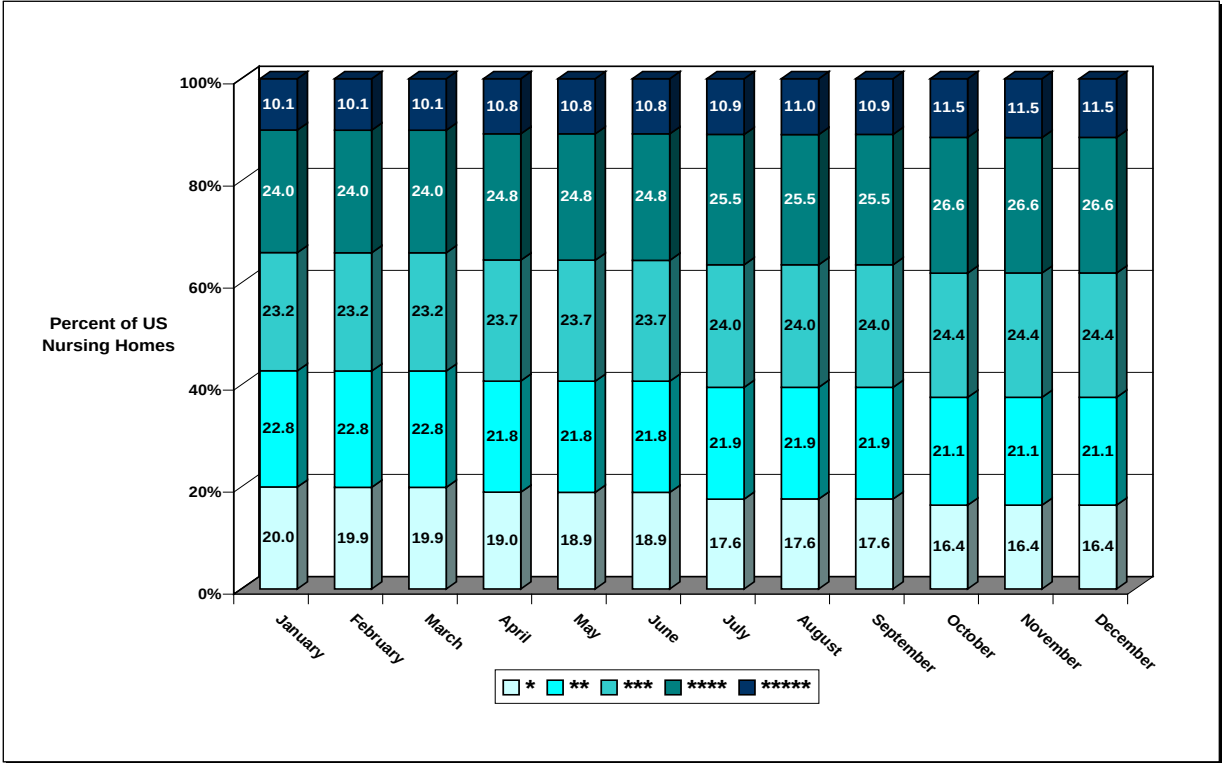


Figure 7. Distribution of MDS Quality Measure Ratings, All US Nursing Homes (January - December 2009)

REACTIONS TO THE RATINGS

While we are beginning to have some data to suggest that the publications of the ratings are having an impact on nursing home performance, their publication has not been without controversy. On the day that the ratings were first

published on the internet (December 18, 2008), there was a front-page story in USA Today. A snapshot of the web version of that story is shown in Figure 8.

While consumer advocacy groups have been generally supportive, some nursing home provider organizations have been less pleased, and continue to raise concerns about the validity of the rating system. Throughout this process CMS has continued to solicit stakeholder input through open door forums and stakeholder meetings, including representatives from nursing home provider organizations and consumer groups. Based on this feedback, and ongoing analyses of the ratings and the underlying data, CMS has made some refinements to the rating system and continues to consider others. Each time a refinement in any of the algorithms is considered, we simulate its effects on the ratings over several months before it is incorporated into the published ratings, always trying to be aware of unintended consequences.

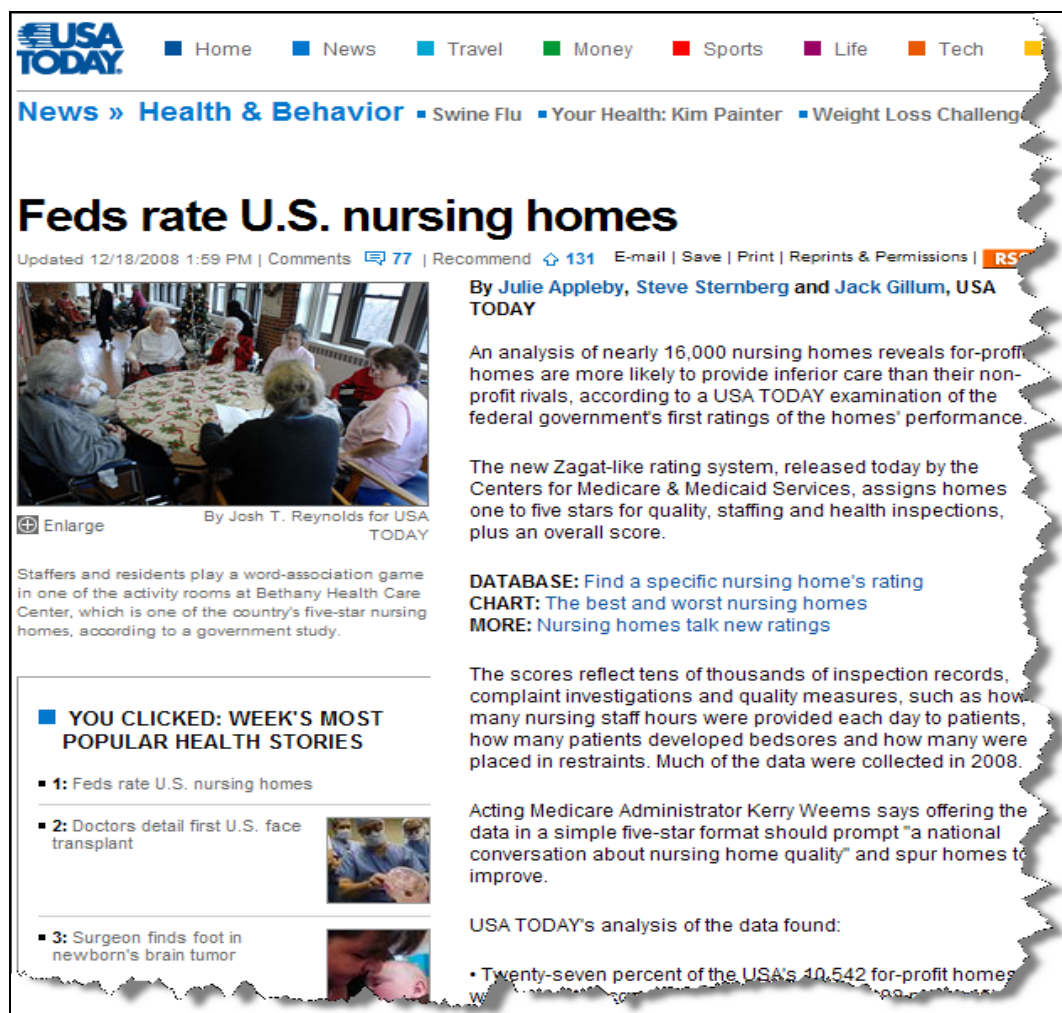


Figure 8. USA Today news article from day the 5-star Ratings were released. It was the week's most popular health story.

CONCLUSION

This paper has presented a lot of technical detail about the construction of the five-star ratings for US Nursing Homes presented on the Medicare website. A benefit of this rather complex behind-the-scenes computation is that the final result is easily understood by consumers. The five-star ratings have brought increased attention to the quality data, and CMS hopes that this will motivate quality improvement on the part of nursing homes. CMS wants the algorithm to be transparent to providers, so they understand what changes need to be made in nursing homes to improve the ratings. There is already some evidence of improvement in performance since the implementation of the rating system.

There are several ways in which CMS plans to further enhance the ratings in the future. Some of the more ambitious goals include:

- Using payroll data for staffing rather than facility report. This will improve the precision of the staffing ratings.
- Including other types of staffing in the ratings, such as physical and occupational therapists.
- Incorporate consumer satisfaction information into the rating system.
- Develop additional quality measures, particularly for short-stay residents. Update the risk-adjustment models for the existing quality measures.

These new data sources will bring additional challenges in terms of data collection, as well as data integration and processing. The goal is to provide consumers with a useful tool to help in choosing a nursing home, though CMS continues to stress that these data will never be a substitute for visiting nursing homes and an ongoing dialogue with facility staff.

REFERENCES

Centers for Medicare and Medicaid Services (CMS), Nursing Home Data Compendium, 2009.

Kramer AM, Fish R. "The Relationship Between Nurse Staffing Levels and the Quality of Nursing Home Care." Chapter 2 in Appropriateness of Minimum Nurse Staffing Ratios in Nursing Homes: Phase II Final Report. Abt Associates, Inc. Winter 2001.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the contributions to the 5-star project from other Abt and CMS colleagues, including Jenny Filopovits, Thomas Kress, and Allison Muma.

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Other brand and product names are trademarks of their respective companies.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the primary author at:

Name: Christianna Williams

E-mail: Christianna_Williams@abtassoc.com or Christianna.S.Williams@gmail.com