

**Frequently Asked Questions (FAQs)  
Implementation and Maintenance of CMS Mortality Measures for AMI & HF**

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## **Justification for the CMS 30-day Risk-Adjusted Mortality Measures for AMI and HF**

### **1. Why measure outcomes?**

The measurement and improvement of core processes for the care of patients with heart attacks and heart failure is a major advance in medical care, but the current process measures capture only a limited spectrum of the actions in the hospital that could influence outcomes. CMS developed the mortality measures to complement existing process measures. Risk-standardized mortality rates (RSMRs) can provide important additional information about quality of care that is not currently captured by the process measures and is currently unavailable to hospitals. Variation in mortality, after adjusting for case mix, may reflect differences in hospitals' general environments (such as coordination of care, patient safety policies, and staffing) or variation in care processes not measured in the current core measure set. Outcome measures can focus attention on a broader set of healthcare activities that affect patients' well being. Moreover, improving outcomes is the ultimate goal of quality improvement, and so the inclusion of outcomes measures assists in attaining improvement goals. Finally, the Deficit Reduction Act of 2005 calls for expanding the set of publicly reported quality measures to include outcomes of hospital care.

### **2. Why measure mortality?**

Mortality is the key outcome for patients hospitalized with heart attacks and heart failure. For almost all patients the treatment strategy is directed toward helping patients survive the acute illness. Lapses in quality commonly increase the risk of mortality. Moreover, mortality can be reliably measured.

### **3. Why measure 30-day mortality?**

The CMS mortality measures assess outcomes at 30 days after admission to the hospital. The evaluation of an outcome using a standardized period of assessment complies with the standards for such measures as articulated in a scientific statement by the American College of Cardiology and the American Heart Association. A standardized period is necessary so that the outcome for each patient is measured in a consistent fashion and that variation in lengths of stay does not have an undue influence on mortality rates. Without a standardized period, institutions would have an incentive to adopt strategies that would shift deaths out of the hospital without improving quality. Although we expect that few, if any, institutions would pursue such strategies, it is important that quality measures do not create incentives for actions that may not be in patients' best interests.

In addition, the period of about 4 weeks after admission is used commonly in cardiovascular studies to assess short-term mortality. Quality of care can affect patient outcomes in this timeframe. Finally, the use of the timeframe — 30-days post-admission — also puts an emphasis on transitions in care and the suitability of the patient for discharge. After discharge the hospital and clinicians have less direct accountability for the outcomes of the patients, but actions taken while a patient is in the hospital and the actions taken by the facility to transition a patient to outpatient status can affect the early risk of the patients.

#### **4. Why measure all cause mortality?**

The CMS mortality measures assess all-cause mortality; that is, they consider deaths for all reasons, not just due to the underlying principal diagnosis. There are several reasons for this choice of outcome. First, from the patient perspective, death from any cause is the key outcome. Attributing mortality to a cause other than heart disease may provide little solace to patients and their families. Second, it is often hard to exclude quality issues and accountability based on the documented cause of death. For example, a patient with heart failure who develops a hospital-acquired infection may ultimately die of sepsis and multi-organ failure. It would be inappropriate to consider the death as unrelated to the care the patient received for heart failure. Another patient might have a complication leading to renal failure, resulting in death that is related to that event and yet quality of care could have reduced the risk of the complication. It is true that this approach will include some patients whose event is truly unrelated to their care. A patient, for example, could be involved in a motor vehicle accident after hospital discharge and the institution could reasonably claim to have had no role in the event. Nevertheless, events completely unrelated to the admission are expected to be uncommon and should not be clustered unevenly among hospitals. Finally, the statistical approach used to estimate hospital mortality rates minimizes the possibility that an additional event will result in a hospital being characterized as an outlier.

#### **5. Why measure and report mortality for only Medicare fee-for-service beneficiaries?**

There are several reasons why it is appropriate to measure and report on mortality rates based only on the experience of Medicare fee-for-service patients. First and foremost, the risk-standardization model requires a set of data related to experience prior to the hospitalization that can best be supplied only by large purchasers. Of the populations represented by various purchasers on Hospital Compare, only Medicare, using its Medicare claims database, which reflects care to the Medicare fee-for-service population, has sufficient national data to meaningfully assess outcomes for AMI and HF patients. Also, Medicare patients (over the age of 65) represent the majority of patients admitted to hospitals with these conditions. These patients are higher risk and more complex, on average, than the younger patients, so the experience of a facility with such patients can be viewed as a more valuable indicator than a measure reflecting commercial populations.

#### **6. How were the CMS 30-day risk-adjusted mortality measures developed?**

The CMS mortality measures were under development for over two years and designed to comply with the standards for such measures as articulated in a scientific statement by the American College of Cardiology and the American Heart Association. CMS contracted with CFMC, Colorado's Medicare Quality Improvement Organization (QIO), to develop a method to calculate the risk-standardized mortality rates for AMI, HF, and pneumonia. To develop and validate the approach, CFMC selected a team of clinical, quality and statistical experts from Yale University, who worked in collaboration with other experts from CMS and Harvard University. The Hospital Quality Alliance (HQA) approved the use of these CMS 30-day mortality measures, contingent upon the measures being endorsed by the National Quality

Forum (NQF). The NQF endorsed the AMI and HF mortality measures in December 2005. CFMC is contracted by CMS as the primary contractor for the implementation and maintenance of the mortality measures along with the Yale team and their collaborators.

**7. Why do you believe administrative data has scientific rigor in building risk-adjustment models?**

CMS sought to develop measures that: (1) could be calculated from its readily available longitudinal claims database for care provided across all care settings; and (2) could be validated by models built on available medical chart data previously abstracted for the QIOs' quality improvement projects. The CMS measures, based on administrative data, produce estimates of risk-standardized mortality rates (RSMRs) that are very similar to rates estimated by models based on chart data. This high level of agreement in the results based on the two different approaches supports the use of the claims-based models for public reporting. The models also demonstrated a consistent performance across years of claims data. For further information on model validation, please see the literature referenced on [www.qualitynet.org](http://www.qualitynet.org).

CMS's approach to gathering risk factors for patients also mitigates the potential limitations of claims data. Because not every diagnosis is coded at every visit, CMS uses inpatient and outpatient claims data for the year prior to admission, and secondary diagnosis codes during the index admission, for risk adjustment. This time frame provides a more comprehensive view of patients' medical histories than is provided by the secondary diagnostic codes of the index hospitalization alone. If a diagnosis appears in some visits and not others, CMS includes it, minimizing the effect of incomplete coding. CMS was careful, however, to include information about each patient's status at admission and to not adjust for possible complications of the admission. Although some codes, by definition, represent conditions that are present before admission (e.g. cancer), other codes and conditions cannot be differentiated from complications during the hospitalization (e.g. infection or shock). If these are secondary diagnoses of the index admission, then they are not adjusted for in the analysis.

**8. How do these outcome measures relate to the current set of process measures? Do you expect any correlation between the two?**

The measure and improvement of core processes for the care of patients with heart attacks and heart failure is a major advance in medical care, and hospitals have demonstrated impressive improvement over the past several years in meeting a discrete set of process of care measures. Patients have clearly benefited from this change in practice. But these process measures are limited in their scope, and capture only a limited spectrum of the actions in the hospital that could influence outcomes.

CMS developed the mortality measures to complement existing process measures. Risk-standardized mortality rates (RSMRs) can provide important additional information about quality of care that is not currently captured by the process

measures and is currently unavailable to hospitals. Variation in mortality, after adjusting for case mix, may reflect differences in hospitals' general environments (such as coordination of care, patient safety policies, and staffing) or variation in care processes not measured in the current core measure set. Outcome measures can focus attention on a broader set of healthcare activities that affect patients' well being. Moreover, improving outcomes is the ultimate goal of quality improvement, and so the inclusion of outcomes measures assists in attaining improvement goals

CMS would expect some correlation between hospitals' performances on the core measures for AMI and HF and on the mortality measures for these conditions, respectively, but for several reasons that correlation may not be strong, as the populations assessed in the two types of measures are somewhat different. Moreover, due to the improvement hospitals have made in the core measures, hospital performance on core measures currently does not vary greatly. In addition, some of the performance measures -- such as medications prescribed at discharge - - may not have a measurable effect on 30-day mortality.

### **Public Reporting Process**

#### **9. Before CMS publicly reports the hospital acute myocardial infarction (AMI) and heart failure (HF) risk-adjusted 30-day mortality rates, will hospitals have an opportunity to preview their data?**

Yes. Each year when the mortality measures are reported, hospitals will have an opportunity to preview their mortality data in conjunction with the 30-day preview for the publicly reported process measures. For the June 2007 reporting of the measures, hospitals were given the opportunity to preview their results in April – May 2007. In addition to providing hospitals with this preview opportunity, CMS conducted a national “dry run” of the measures during December 2006 and January 2007 using older (2003) test data. The purpose was to familiarize hospitals with the measure methodology and the mortality data, and to test and improve the reporting process. For more information, including a detailed summary of the dry run, please visit [www.QualityNet.org](http://www.QualityNet.org).

#### **10. What years of data were used to calculate the AMI and HF 30-day mortality measures to be published in June 2007? What is the source of the data?**

The information contained in the June 2007 reports is based on administrative Part A and Part B claims submitted by hospitals prior to September 30, 2006, for services provided during the period of July 2005 to June 2006. Hospital inpatient claims from July 1, 2005 – June 30, 2006 are used to identify the cohort of patients to include and to provide specific characteristics of the index hospitalization. Hospital inpatient and outpatient claims and physician practice claims data are used to characterize comorbidity as documented during the index admission and in the year before the admission. This timeframe provides a more comprehensive view of patients' medical histories than is provided by using only the secondary diagnostic codes of the index hospitalization. The Medicare enrollment file is used for beneficiary demographic information. Mortality information is derived from the Medicare enrollment file, which is updated by the Social Security Administration, or from inpatient hospital claims.

## **11. Can my hospital suppress its data?**

As stated in Section 1886(d) (of the Social Security Act): “Facilities that register for “Reporting Hospital Quality Data for Annual Payment Update” (RHQDAPU) should be aware that, in order to receive full Annual Payment Update for FY2008, they will not be able to suppress their mortality measures.” In order to receive full APU, participation in the reporting will be required for all RHQDAPU hospitals; however, performance on the mortality measures will not affect a hospital's APU.

Critical access hospitals (CAHs) and section 1886(d) hospitals that are HQA-only participating facilities will be able to suppress publication of their mortality measures during the preview period that precedes the reporting of the measures, each quarter. While the mortality measures will only be refreshed annually, the initial set of results will be reported each subsequent quarter, for one full year. Eligible hospitals will need to suppress each quarter if they do not want their results posted on the Hospital Compare Web site.

To withhold publication of its performance on the measures, the provider must contact its QIO hospital public reporting contact with its request to withhold and transmit a completed “Request for Withholding Data from Public Reporting” form to that contact no later than the end of the preview period for that quarter. The form and QIO contacts for each state are located within the HQA section of the QualityNet website at <http://www.qualitynet.org/dcs/ContentServer?cid=1121785350618&pagename=QnetPublic%2FPage%2FQnetTier2&c=Page>

## **12. My hospital does not currently report data for the Hospital Compare Web site ([www.HospitalCompare.hhs.gov](http://www.HospitalCompare.hhs.gov)). How can we see our mortality rates?**

Hospitals not currently reporting data for Hospital Compare and thus, not registered on QNet Exchange, will not be able to view their individual hospital rates for the AMI and HF 30-day mortality measures. However, these hospitals will be able to access a “mock” hospital-specific report (HSR) on [www.qualitynet.org](http://www.qualitynet.org) after mid-June 2007, when the measures are publicly reported. The mock HSR contains a “mock” hospital mortality rate and simulated patient level data. Use of simulated data ensures that hospitals gain experience looking at the rates but do not see data reflective of any hospital's actual experience.

## **13. My hospital is not yet registered for QualityNet Exchange. How do we get registered?**

All hospitals not currently registered for QualityNet Exchange are encouraged to consider registration. Instructions for registration can be found at (<http://www.qualitynet.org/dcs/ContentServer?cid=1138115987954&pagename=QnetPublic%2FPage%2FQnetBasic&c=Page>) Once you are successfully registered, and have a QNet Inbox with the designated role - “QIO Clinical Warehouse Feedback Reports”, contact the Colorado Foundation for Medical Care (CFMC) via email at [mortalitymeasures@coqio.sdps.org](mailto:mortalitymeasures@coqio.sdps.org) to request an upload of your hospital-specific report.

## **Risk-Standardized Mortality Rates (RSMRs)**

### **14. How are the risk-standardized mortality rates (RSMRs) calculated?**

In brief, CMS uses a hierarchical generalized linear model to estimate the RSMRs. This differs from the typical logistic regression approach. For comparison, a common approach to reporting hospital-specific risk-adjusted mortality derived from logistic regression involves three components:

- The observed or crude number of deaths;
- The expected number of deaths given the patients' risk factors, estimated from the regression model; and,
- The crude national rate.

The ratio of observed deaths to expected deaths (referred to as "O/E ratio" in many other public reports) is used to assess whether the hospital had more deaths than expected (ratio > 1.0), the same number of deaths as expected (ratio = 1.0), or fewer deaths than expected (ratio < 1.0). This number is then multiplied by the national mortality rate, so that the hospital's adjusted death rate may be compared to the national rate. When this approach is used, the O/E ratio for hospitals with a low volume of AMI or HF patients is often driven to extremes by all outcomes because the ratio is based on a small number of cases.

CMS's methodology differs in several ways from the above logistic regression modeling approach and the reporting of an O/E ratio. CMS mortality measures are derived from a hierarchical model that takes into account not only patient risk factors, but also a hospital-specific effect. The hospital-specific effect is an estimate of the average impact of being treated in a particular hospital on the likelihood of dying. The estimate accounts for the number of cases on which the hospital's rate is based and the similarity of outcomes and characteristics of patients treated at the same hospital.

A ratio similar to the O/E but applicable to the hierarchical model also contains three components, however they are calculated differently:

- CMS uses predicted mortality in the ratio numerator instead of the observed number of deaths. This numerator is the number of deaths predicted by the hierarchical model among a hospital's patients, given the patients' risk factors and the hospital-specific effect.
- The denominator is the expected mortality (number of deaths) among that hospital's patients given the patients' risk factors and the average of all hospital-specific effects in the nation.
- CMS takes the ratio of the numerator and denominator explained above (predicted/expected or P/E), and multiplies the ratio by the crude national rate to obtain the RSMR. Thus, each hospital's RSMR is to be compared to the observed national rate and not to other individual hospitals' RSMRs. The national observed rate serves as the reference for comparison purpose.

Because hierarchical modeling is used, there is no minimum hospital sample size required for inclusion in this model. The analytical method increases the effective

sample size for each hospital. While the O/E ratio for small hospitals is often driven to extremes (high or low) as previously mentioned, the P/E ratio is more likely to result in a value that is much closer to the average. This means that while low volume hospitals are eligible for RSMR calculations, their rates may not be as meaningful as they would be if their patient volume were higher. For a detailed discussion of low volume hospitals please see the section of this report on small volume hospitals. For a more detailed discussion of the RSMR calculation, please see the Methodology report available at [www.qualitynet.org](http://www.qualitynet.org).

**15. Will hospitals be able to duplicate the risk-adjusted mortality rates (RSMRs) calculation, for purposes of validation?**

Hospitals will not be able to independently calculate the RSMRs. The risk adjustment coefficients used as well as the individual patients' data included in the analyses are in the HSRs. But the model requires input of patient longitudinal data across care settings and also data from the entire national sample to estimate risk factor coefficients and the hospital-specific effects used in the equations. Since these data are unavailable to hospitals, hospitals will not be able to independently estimate these equations. But to be transparent in how the RSMRs are calculated, CMS will make the methodology (including the HCC algorithm) available on [www.qualitynet.org](http://www.qualitynet.org) and the CMS Web site.

**16. Where can I find more information about how the mortality rates are calculated?**

The best source of information on the risk-adjustment model is the methodology report, Risk-Adjustment Models for AMI and HF 30-Day Mortality: Methodology, posted on [www.qualitynet.org](http://www.qualitynet.org). (<http://www.qualitynet.org/dcs/ContentServer?cid=1163010421830&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page> )

Additional references on the measures and on the statistical model used (the hierarchical generalized linear model) can also be found on [www.qualitynet.org](http://www.qualitynet.org), including:

1. Krumholz HM, et al. An administrative claims model suitable for profiling hospital performance based on 30-day mortality rates among patients with heart failure. *Circulation* 2006;113:1693-701. (<http://circ.ahajournals.org/cgi/reprint/113/13/1693>)
2. Krumholz HM, et al. An administrative claims model suitable for profiling hospital performance based on 30-day mortality rates among patients with an acute myocardial infarction. *Circulation* 2006;113:1683-92. (<http://circ.ahajournals.org/cgi/reprint/113/13/1683>)
3. Krumholz HM, et al. Standards for statistical models used for public reporting of health outcomes. *Circulation* 2006;113:456-62. (<http://circ.ahajournals.org/cgi/reprint/113/3/456>)



## **Hospital-Specific Reports**

### **17. What information is included in the Hospital-Specific Reports?**

The Hospital-Specific Report (HSR) describes CMS' approach, lists patients covered by the analysis, and presents the results for your individual hospital. It is designed to provide important information to aid you in your quality improvement efforts and help you understand what will be publicly reported. A "mock" HSR can be viewed at [www.qualitynet.org](http://www.qualitynet.org) after mid-June 2007, in conjunction with the measures being publicly reported on Hospital Compare.

### **18. Why didn't my hospital receive a Hospital-Specific Report (HSR) for the June 2007 public reporting?**

If your hospital didn't receive an HSR for the June 2007 reporting period, it is could be due to any of the following:

- Your hospital was not open during July 2005 - June 2006
- Your hospital had no eligible cases in July 2005 – June 2006
- Your hospital is not currently pledged for either APU or HQA, or did not pledge prior to the preview period.
- Your hospital did not have a registered QualityNet Exchange user with the designated role of "QIO Clinical Warehouse Feedback Reports".

If any of the above applies to your hospital, you will not be able to view your individual hospital rates for the AMI and HF 30-day mortality measures.

All hospitals will be able to access a "mock" report on [www.qualitynet.org](http://www.qualitynet.org) after mid-June 2007, when the measures are publicly reported. The mock HSR contains a "mock" hospital mortality rate and simulated patient level data. Use of simulated data ensures that hospitals gain experience looking at the rates but do not see data reflective of any hospital's actual experience.

If none of the above applies to your hospital, and you still did not receive a report, please contact [mortalitymeasures@coqio.sdps.org](mailto:mortalitymeasures@coqio.sdps.org).

## **Characteristics of the Model**

### **19. What are the inclusion-exclusion criteria for the CMS 30-day mortality measures for AMI and HF?**

The CMS 30-day Mortality Measures for AMI and HF include fee-for-service Medicare enrollees with a principal discharge diagnosis of AMI (for AMI calculations) or HF (for HF calculations) at least 65 years of age at the time of their admission who were enrolled in fee-for-service Medicare during their admission and for at least one year prior to their admission.

The specific ICD-9-M codes meeting the inclusion criteria for AMI and HF are as follows:

- For the acute myocardial infarction (AMI) measure: 410.00, 410.01, 410.10, 410.11, 410.20, 410.21, 410.30, 410.31, 410.40, 410.41, 410.50, 410.51, 410.60, 410.61, 410.70, 410.71, 410.80, 410.81, 410.90 & 410.91; and
- For the heart failure (HF) measure: 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43 & 428.9

The following patient admissions are excluded from each hospital's report and risk standardized mortality rate (RSMR) calculation for both AMI and HF:

1. Patients less than 65 years old;
2. Patients with incomplete administrative data for the period 12 months prior to the index admission date (e.g. not enrolled in Medicare Part A and Part B or enrolled in a managed care plan);
3. Cases with a length of stay of  $\leq 1$  day discharged alive (and not discharged against medical advice or transferred to another hospital within their first day of admission), because these patients are unlikely to have a true diagnosis of AMI or HF;
4. Cases with a total length of stay exceeding one year;
5. Patients who transfer out who do not have a primary discharge diagnosis of AMI or HF, respectively, at the receiving hospital (to confirm the diagnosis);
6. Patients with unknown mortality information (date of death before date of index admission or date of death before discharge date for patients discharged alive);
7. HF cases excluded from your hospital's measures because of multiple admissions (If there were multiple HF admissions for a patient in the 12 months studied, one hospitalization per patient was randomly selected for inclusion after applying the other exclusion criteria);
8. Patients admitted to your hospital who were transferred in (these patients are included in the first hospital's report); and
9. AMI admissions for patients who had been previously admitted to your hospital or another hospital and died within 30 days of their first admission (these cases are also included in the first hospital's report).

The patient population for the mortality measures is likely to differ from that included in each hospital's process measures for several reasons, including:

- Only Medicare fee-for-service patients were included in the analysis (due to data availability);

- Patients transferred to a second hospital after admission were linked to the first (index) hospital admission;
- If there were multiple HF admissions for a patient in the 12 months studied, one hospitalization per patient was randomly selected for inclusion after applying the other exclusion criteria (see below); and
- The process measures only include AMI and HF patients for whom each specific measure (e.g. a specific medication) is appropriate.

The inclusion and exclusion criteria for the model were chosen for clinical or practical reasons. For example, a patient must have fee-for-service data for a complete year prior to their admission so that the model can fully capture their risk factors at admission. CMS will continue to review the criteria as the measures are maintained.

## **20. Does the analysis exclude patients admitted for hospice or comfort care?**

Patients that are admitted to the hospital for signs and symptoms of decompensated heart failure or AMI and whose goal is comfort rather than survival, are not excluded by the model. We recognize that death is not always an unexpected event, especially for a condition such as heart failure. Death, for example, may represent the inevitable end to a long, chronic illness and not in any sense a failure of the system. Some patients or patients' families elect comfort-only or hospice care on admission or during their hospital stay.

We addressed this concern by taking each patient's health status on admission into consideration. Using inpatient and outpatient claims data for the year prior to admission, the model adjusts for a number of factors associated with the likelihood that patients are at the end of their lives, including protein-calorie malnutrition, metastatic cancer, dementia, and age. Hospitals with very sick patients, therefore, will be expected to have more deaths, and the model will adjust their risk standardized mortality rate (RSMR) accordingly.

In addition, we were careful in our approach to include information about each patient's status at admission and to not adjust for possible complications of the admission. Although some codes, by definition, represent conditions that are present before admission (e.g. cancer), other codes and conditions cannot be differentiated from complications during the hospitalization (e.g. infection, shock, and transition to comfort care-only or hospice status). Excluding patients from the analysis who transition to comfort care or hospice may inadvertently reward hospitals that poorly manage their patients.

For the vast majority of patients with heart failure or AMI, the goal is survival. We know that differences in RSMRs to some degree reflect differences in the quality of cardiac care and differences in hospitals' general environments (such as coordination of care, patient safety policies, and staffing). The mortality measure information and patient-level data we provide to hospitals should help hospitals identify and address areas of concern.

The goal of this initiative is to promote quality improvement. Hospitals that admit a disproportionate number of patients for hospice or comfort measures may have good reasons for doing so (e.g. a lack of alternative end of life care providers in the community). If, as a result, a hospital's RSMR is higher than expected, the hospital may choose to share the reason publicly and engage its community in a discussion of the hospital's role in end of life care.

## **21. How are transfer patients handled in the model?**

Patients who are admitted to a hospital with a diagnosis of HF or AMI and then transferred are included in the measures. The model considers an episode of care starting at admission to the first hospital, and assigns the patient's outcome to the hospital to which the patient was initially admitted. These patients are not counted for the hospitals that receive them. Those seen in the emergency department only and transferred to another hospital are counted at the receiving hospital.

Assigning outcomes to the admitting hospital has two advantages. First, it allows CMS to assess systems of care and how well they are serving Medicare patients. Actions taken at the admitting hospital, during the transfer, and at the receiving hospital all can affect outcomes. CMS hopes this approach will encourage coordination between hospitals and their referral network. Second, this approach avoids creating an incentive for hospitals to refer patients who are critically ill and at high risk of dying to other institutions. Although it is unlikely that hospitals would act on such an incentive, it is important that measures do not create incentives for actions that may not be in the best interest of the patient.

## **22. How does the model treat small volume hospitals?**

We have taken a careful approach to assessing small volume hospitals. A key factor in accurately classifying a hospital's quality of care is the number of patient cases that are available for observation. Some hospitals have small numbers of cases; this is a constraint that one cannot circumvent. In developing the model for the 30-day mortality measures, CMS had a choice of excluding "small" hospitals entirely from the report or including as many hospitals as possible while honestly reflecting the amount of certainty we had in the estimates. CMS adopted the latter strategy.

We have addressed this challenge in two major ways. First, we chose a statistical model that allows us to include hospitals with relatively few observations but takes into account the uncertainty associated with sample size in estimating their risk-standardized mortality rates (RSMRs). As described in this report and in the supporting reports available on QualityNet.org (<http://www.qualitynet.org/dcs/ContentServer?cid=1163010421830&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page>), we use a hierarchical generalized linear model to adjust for patient risk factors and to estimate a hospital-specific quality effect. This "hospital-specific effect" is an estimate of the average impact of being treated in a particular hospital on the likelihood of dying within 30 days of admission.

A key characteristic of the model is its ability to avoid producing unreliable estimates for hospitals having few patients. Conceptually, the estimated hospital-specific effect for a small volume hospital gets pulled toward the average because the limited number of cases in the hospital tells us little about that hospital's true RSMR. Therefore, the best estimate is close to the national average. This approach, in turn, makes the estimated RSMRs for smaller hospitals more likely to be closer to the national mortality rate (see Figure 9, p AMI-43, of methodology report at the above link). In the extreme case where a hospital had only one case we would not want to report that the mortality rate was 0% (if there were no deaths) or 100% (if that single patient died). The model would estimate this hospital's true mortality rate at close to the national average (slightly below or above depending on the patient's outcome). Each estimate has an associated 95% interval estimate (similar to a confidence interval) so that the precision of the estimate can be understood.

Second, CMS is proposing an approach to categorizing hospitals for public reporting that reflects the greater uncertainty associated with small volume hospitals' RSMRs. As explained in this report, each hospital's RSMR is only interpreted in the context of its 95% interval estimate, and whether that estimate contains the raw national mortality rate. The interval estimate will generally be wider for small hospitals given the greater uncertainty in their RSMR estimate, and therefore will be more likely to encompass the national mortality rate.

In summary, given our statistical model and CMS' approach to reporting the model's results, CMS will characterize the performance of nearly all small volume hospitals on the Hospital Compare Web site as "no different than U.S. national rate". Finally, CMS will allow HQA-only and CAH hospitals to suppress reporting of their summary measure on Hospital Compare if they so choose.

### **23. What about hospitals that do not provide cardiac surgery or percutaneous coronary intervention (PCI) and that routinely transfer patients needing these services to other hospitals?**

CMS agrees that transferring patients for interventional care is often the most beneficial option for the patient. Assigning outcomes of transferred patients to the hospital that admits the patient initially has two advantages. First, it allows CMS to assess systems of care and how well they are serving Medicare patients. Actions taken at the first admitting hospital, during the transfer, and at the receiving hospital all can affect outcomes. This approach should encourage coordination between hospitals and their referral network. If patients are consistently doing worse at the receiving hospital then this is the basis for a discussion between the two facilities. Second, this approach avoids creating an incentive for hospitals to refer patients who are critically ill and at high risk of dying to other facilities.

CMS addressed the concern of bias against small hospitals without interventional capability in two ways. First, the model takes each patient's health status on admission into consideration. Using inpatient and outpatient claims data for the year prior to admission, the model adjusts for a number of factors associated with the likelihood that patients are at high risk of dying, including protein-calorie malnutrition, metastatic cancer, dementia, and age. Hospitals with very sick patients, therefore, will be expected to have more deaths, and the model will adjust their risk

standardized mortality rate (RSMR) accordingly. Second, hospitals are only assigned the patient if the patient is admitted at their hospital; patients seen only in the ED and then transferred are assigned to the receiving hospital. This approach limits small hospitals' accountability when limited care is provided

**24. How do the measures address patients with multiple AMI and HF admissions in the reporting year?**

CMS handles multiple admissions for HF and AMI patients differently. Because HF patients commonly have multiple admissions during the course of a calendar year, not all of which are at the same hospital, CMS randomly selected one admission for inclusion for each HF patient in the study sample after applying the other exclusion criteria. Because the selection is random, this approach should not bias the model's results against any hospitals

Since the AMI readmission rate is relatively lower than that of HF, all admissions with the primary discharge diagnosis of AMI are included in the model. If a patient dies within 30 days of an admission and is readmitted before that death to the same or another hospital, CMS assigns the death to the first hospital and the AMI mortality calculation excludes the second hospitalization.