Measuring Rural Hospital Quality

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EXECUTIVE SUMMARY

This paper examines quality measurement for hospitals in rural settings. We seek to identify rural hospital quality measures that reflect quality in all hospitals and that are sensitive to the rural hospital context. We develop a conceptual model for measuring rural hospital quality, with a focus on the special issues (e.g. smaller scale, greater reliance on generalists, constrained resources, importance of linkages with the local community and with referral centers) posed by the rural hospital context for quality measurement. With the assistance of a panel of rural hospital and hospital quality measurement experts, we review hospital quality measures from national and rural organizations for their fit to rural hospitals. The four criteria used to assess hospital quality measures included the prevalence (of the condition) in small rural hospitals, the ease of data collection effort, the internal usefulness of the measure for small rural hospitals, and the external usefulness for small rural hospitals.

Based on this analysis, we recommend an initial core set of quality measures relevant for rural hospitals with less than 50 beds. This core set of 20 measures includes 11 core JCAHO measures related to community acquired pneumonia, heart failure, and AMI; one measure related to infection control; three measures related to medication dispensing and teaching; two procedure-related measures; one financial measure and two other measures related to the use of advance directives and the monitoring of ER trauma vital signs.

Based on the special measurement needs posed by the rural hospital context, we suggest avenues for future quality measure development for core rural hospital functions (e.g. triage, stabilization and transfer; emergency care; integration of care with other local providers) not considered in existing quality measurement sets. We discuss our current collaborative efforts with the QIOs in Minnesota and Utah/Nevada to field test the feasibility of collecting and using hospital quality measures relevant to the rural environment. Our goal is to help rural hospitals with less than 50 beds to start building quality measurement capacity in small definable parts, and experience the value of using quality data for internal and external purposes, before they expand the scope and sophistication of their quality measurement system.

INTRODUCTION

In recent years, there has been increased interest in the measurement of hospital quality through measures of clinical processes and outcomes (O'Malley, 1997). Accreditation organizations such as the Joint Commission on the Accreditation of Healthcare Organizations have proposed new measurement strategies (ORYX) based on core measures (Braun, Koss and Loeb, 1999), purchaser coalitions such as Leapfrog have pushed for the adoption of new hospital quality measures and systems (Milstein et al., 2000; Shannon, Marshall and Coleman, 2002), government agencies such as the Agency for Healthcare Research and Quality have developed algorithms for measuring hospital performance using discharge data (AHRQ, 2003), and the National Quality Forum, a voluntary consensus standard-setting organization, has developed a performance measurement set for hospitals in the U.S. (National Quality Forum, 2002). Some organizations, such as the Rural Wisconsin Health Cooperative and Apples to Apples have proposed quality measurement systems specific to rural hospitals.

The multitude of measures and measurement systems can lead to confusion about what and how to measure quality. This has been addressed in part by work groups composed of representatives from a broad range of organizations reviewing and standardizing measures (NQF, 2002). This paper extends this work by addressing the special issues related to rural hospital quality measurement.

One could argue "quality is quality" and that it should not vary across types of hospitals. This is certainly true for many measures of quality, such as prescribing aspirin for those who have had an acute myocardial infarction. But, it is not necessarily true for all measures because hospital context varies systematically across different types of hospitals. These contextual differences pose systematic differences in care process demands on a hospital. These differing

demands result in variation in the types of care management problems addressed by hospitals. To be effective, quality measurement should be sensitive to these differences. One difference is simply measurement reliability. Reliable volume-based mortality measurement requires a volume that may not be reached in many rural hospitals. Another difference is condition prevalence, which varies across hospital types (Moore, 1998). A final difference is the relative importance of care management processes. For rural hospitals a key care management process is the triage-and-transfer decision. While this decision is important in urban hospitals, it is more important in rural hospitals because of their role as a link between rural and urban settings. Measuring quality of the triage-and-transfer decision process may have a higher priority in rural than urban hospitals.

This paper examines quality measurement for hospitals in rural settings. We seek to identify rural hospital quality measures that reflect quality in all hospitals and that are sensitive to the rural hospital context. First, we develop a conceptual model for measuring rural hospital quality, with a focus on the special issues posed by the rural hospital context for quality measurement. Second, with the assistance of a panel of rural hospital and hospital quality measurement experts, we review hospital quality measures from national and rural organizations for their fit to rural hospitals. Based on this analysis, we recommend an initial core set of quality measures relevant for rural hospitals with less than 50 beds. Third, based on the special measurement needs posed by the rural hospital context, we suggest avenues for future quality measure development and discuss our current efforts to field test the feasibility of collecting and using hospital quality measures relevant to the rural environment.

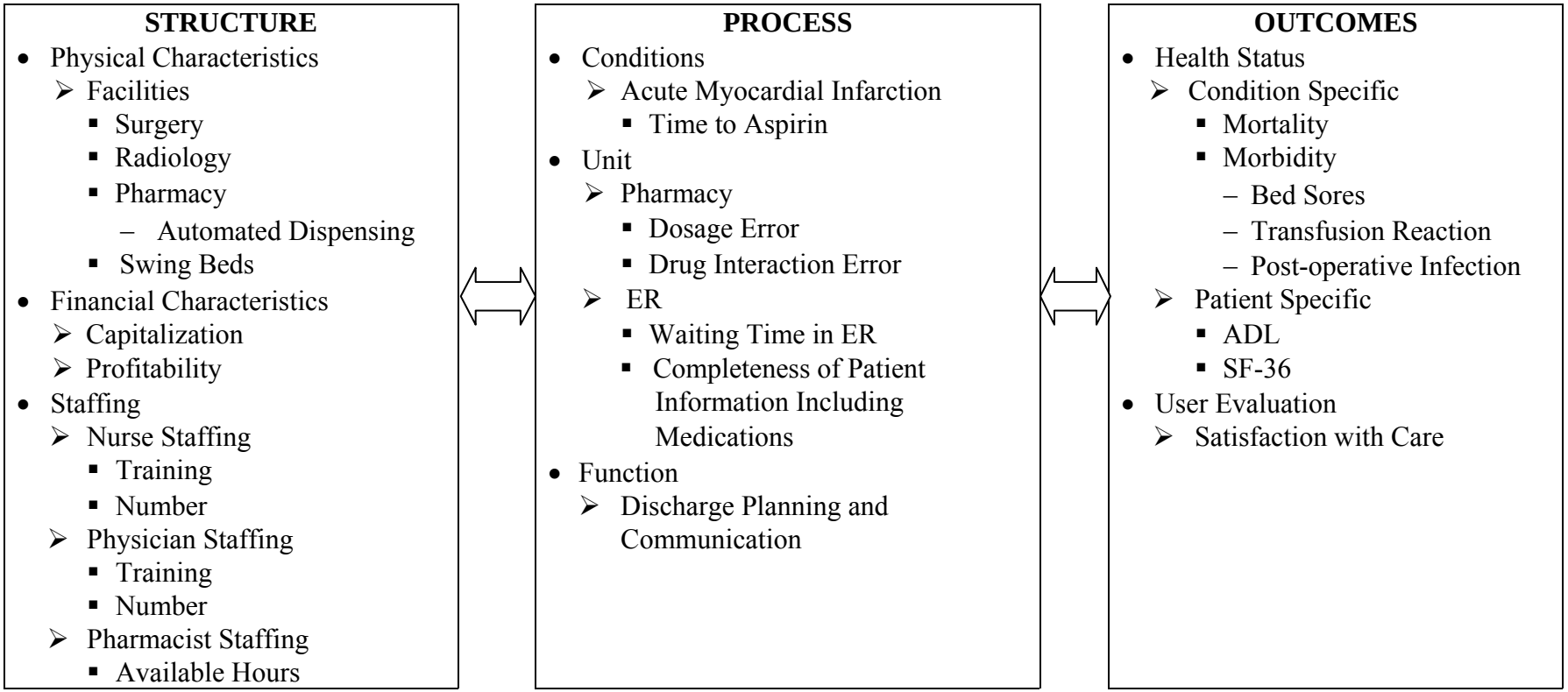
A MODEL FOR MEASURING RURAL HOSPITAL QUALITY

We define rural hospital quality as the degree to which organizational structures and processes in rural communities increase the likelihood of positive health outcomes for individuals. Campbell, Roland and Buetow (2000) define quality of care as "whether individuals can access the health structures and processes of care which they need and whether the care received is effective." A high quality rural hospital has in place those structures and processes that maximize individual quality of care. In high quality rural hospitals, patients receive appropriate care for their condition. In a high quality rural hospital, aspirin will be administered quickly to those presenting with an acute myocardial infarction. In a high quality rural hospital, patients who cannot be treated with the services available in the rural hospital are quickly and accurately identified and transported to a location where they can receive the services they need.

Rural hospital quality can be measured with structure, process, and outcome measures (Figure 1) (Campbell, Roland and Buetow, 2000; Donabedian, 1980, 1988). Structure refers to the facilities, staffing, and organization of the rural hospital. Structure provides the context for rural hospitals' health care work and processes. It refers to the types of services that the rural hospital is equipped to provide (e.g. thrombolysis), the types of professionals available to deliver services (e.g. staffing levels for nurses, physicians and pharmacists), the types of infrastructure to support work (e.g. systems for the storage, distribution and administration of high-risk medications), and the types of rules, norms, or culture that govern interaction (e.g. norms that support discussing errors openly). Although research may show a correlation between structure and outcomes (e.g. between nurse staffing levels and errors) (Needleman et al., 2002), the effect of these structural elements occurs through rural hospital processes. Processes are "the actual delivery and receipt of care" (Campbell, Roland and Buetow, 2000) or those activities supporting

Figure 1

Conceptual Model for Measuring Rural Hospital Quality



Adapted from Campbell, S., Roland, M., and Buetow, S. "Defining Quality of Care." *Social Science & Medicine* 51:1611-1625, 2000.

the delivery and receipt of care. Processes can be divided into technical and social components, with technical referring to doing the right thing at the right time (e.g., providing aspirin quickly to those with an acute myocardial infarction) and social referring to the interaction with the patient (e.g., obtaining informed consent, counseling about end-of-life options). Outcomes are the consequences that patients experience, their mortality, morbidity (e.g., nosocomial and post-operative infections), and perceptions of the care process (e.g., satisfaction with care delivery, feeling involved and empowered in the care delivery process).

Each of the types of measures has its strengths and weaknesses (Campbell, Roland and Buetow, 2000; Davies and Crombie, 1998; Brook, McGlynn and Cleary, 1996; McGlynn, 1997, 2003a). While structural measures are most easily observed, their relationship to individual outcomes is indirect and distant, usually being mediated by health processes. While individual outcomes directly measure the quality of individual care, some are difficult and costly to measure, occur so rarely (e.g. mortality), or occur after such a significant time lag, that they are difficult to measure, particularly in a rural hospital setting. Process measures, such as making sure AMI patients receive aspirin, have the important advantages that they are "common, under the control of health professionals, and may be more rapidly altered" than structural or outcome measures (Campbell, Roland and Buetow, 2000). Process measures are also advantageous because they can be used to measure integration by carefully choosing sets of related process measures. Care integration can be measured by focusing on episodes of care, such as all the steps in treating pneumonia. The quality of core hospital functions such as pharmacy services can be measured with a measurement set that includes rates such as dosage errors, drug-drug interactions, rates of testing bacteria to determine appropriate antibiotic use, or antibiotic-infection mismatches.

Outcome measures, such as infection or adverse drug event rates, have the important advantage of being direct measures of quality. But, with rare events such as post-surgical infection or conditions of low prevalence in a hospital, reliable measures may be difficult to construct. There also is difficulty in constructing outcome measures if the outcome occurs in a different institutional setting than where the care was provided because of the difficulty tracking care records across multiple sites. An example is measuring outcomes for a patient with an acute myocardial infarction who is stabilized in a rural hospital and then transferred to an urban hospital. In these cases, process measures that capture more frequent events may be more reliable (McGlynn, 2003a). Although outcomes are of central interest, structural or process measures should be used only when there is evidence that shows they are related to individual quality of care (Campbell, Roland and Buetow, 2000; McGlynn, 2003b).

Structure, process, and outcome measures provide an important perspective on how quality should be measured. It also is important to consider what aspects of rural hospital quality should be measured. Potential measures come in a broad range, including measures of clinical processes for specific conditions (e.g., aspirin at arrival for acute myocardial infarction), counts of complications or errors (e.g. adverse drug events, medication errors, post-operative infections, or returns to the operating room), rates of use of specific procedures (e.g. C-sections) and mortality rates. Many of these measures have also been developed in priority-setting exercises focused on urban hospitals, which may not include measures important to rural hospitals (e.g. patient triage and transfer, coordination with EMS).

The goal of this research is to examine the important issues for measuring rural hospital quality and to define a set of quality measures that are relevant to rural hospitals. We first reviewed literature on quality measurement (Campbell, Roland and Buetow, 2000; McGlynn,

2003a. 2003c), rural hospital context (Davidson and Moscovice, 2003) and quality (Brasure, Stensland and Wellever, 2000; Moscovice and Rosenblatt, 2000; Calico et al., 2003) to identify questions related to rural hospital quality measurement. To review specific quality measures, we identified quality measures commonly used in national quality measurement efforts or used by rural hospitals, and formatted them for review. We then asked a panel of experts in rural health care, rural hospitals, and quality measurement to review and rate the specific hospital quality measures for their relevance to rural hospitals and to then meet in-person to review and discuss the issues raised by the literature review and to review their ratings. The 13-member expert panel included representatives from key national quality organizations as well as rural health professionals and employers knowledgeable about quality issues (see Appendix 1 for the names and affiliations of the members of the expert panel).

In the discussions with the panelists, we asked them to assume the context of a rural hospital of less than 50 beds (AHA, 2001). The median size of rural hospitals less than 50 beds is 32 beds. The average rural hospital with less than 50 beds has an average daily census of 12, 906 admissions per year, 163 surgical operations per year, and 80 births per year. The most prevalent conditions treated at these facilities include pneumonia, births, congestive heart failure, and chronic obstructive pulmonary disease.

RURAL HOSPITAL QUALITY MEASUREMENT ISSUES

At their in-person meeting, the expert panel addressed what issues are important in measuring rural hospital quality, by focusing on the questions:

- How do rural and urban hospital contexts differ?
- What should be the balance between measuring units (e.g. laboratory, pharmacy), processes (e.g. infection control), and specific conditions (e.g., treatment for acute myocardial infarction)?

- Is it best to measure a few units, processes, or conditions in depth or is it better to measure a broad range of units, processes, or conditions each with only a few measures?

- Are there significant types of measures that are important for measuring rural hospital quality that are not included in existing measurement sets?

- What should be the relative emphasis of measurement - supporting process improvement, benchmarking, and/or report cards?

- How should the limited patient volume of many rural hospitals be addressed in quality measurement efforts?

Our interpretation of the panel's discussion is summarized below.

The Rural Hospital Context

There was agreement about the importance of quality measures of appropriate clinical care (e.g. providing aspirin for an acute myocardial infarction) and the support of a culture of collaboration where it is safe to discuss problems, near-misses and errors in both rural and urban hospitals. In addition, a number of rural-specific quality measurement issues were identified.

Rural Hospitals are Smaller, Less Complex, and Rely More on Generalists

Rural hospitals tend to be smaller, perform less variety of procedures, and are less complex organizations than urban hospitals. Rural hospitals also rely more on family practitioners and generalists than urban hospitals because they do not have the condition-specific volumes necessary to support specialized staff. This results in a stronger reliance on staff who deal with conditions on an intermittent, irregular basis, or with staff performing functions that would be performed by more specialized individuals in a larger hospital. Examples of support systems for the rural hospital context, which could be used as quality measures, are the presence of protocols for acute myocardial infarction on emergency room walls, the use of those protocols, and refresher training for infrequently encountered conditions. Another example is the support provided for a rural hospital nurse mixing an IV drug solution late at night because a

pharmacist is not available in the hospital. Quality measurement in this case needs to focus on the types of support and protocols available for the nurse mixing drugs. Because of the smaller size, reduced complexity, and reliance on generalists, quality measurement needs to capture how well a rural hospital supports and provides care given by generalists.

Smaller size also has consequences for being able to purchase capital intensive equipment or support specialized staff. A literature review of infection control and surveillance programs (ICSP) recommended four best practice components: intensive surveillance with feedback of infection rates to practitioners; a strong emphasis on sterilization, such as hand washing; an infection control nurse to supervise the ICSP and analyze data; and a physician or microbiologist specialized in infection control involved in the program (DHS, 2003). While some of these may be easily implemented in each rural hospital, (e.g. emphasizing hand washing) others, such as having a dedicated infection control nurse or microbiologist, may be more difficult to implement. The rural hospital may be able to accomplish this function by working with a regional rural hospital group or a tertiary care medical center to support a microbiologist. Similarly, a rural hospital may not be able to support specialized quality improvement staff to support quality improvement activities. Since the effective rural hospital must adapt to the constraints posed by its size to perform necessary functions, the rural hospital quality measurement system must be able to measure a variety of ways of performing some functions. Smaller size does pose some problems, it also provides some advantages. The smaller size should result in less isolation and more interaction among staff, which may make it easier to develop a shared culture.

Resource Environments are Constrained and Diverse

Rural hospital resource environments are more constrained than urban hospitals' and there is also substantial diversity across rural communities. This includes the availability of

personnel (e.g. registered nurses) and other types of health care organizations (e.g. nursing homes and home health agencies). These contextual differences affect rates of hospital use and possibly readmission rates. The availability of other types of institutions, such as nursing homes, may be a determinant of different patterns of hospital use in rural areas than in urban areas (Coburn, Keith and Bolda, 2002; Coburn, Bolda and Keith, 2003). The implication is that rural hospital quality is influenced by contextual issues that are addressed both by broad public policy (e.g. developing programs to increase personnel availability in rural areas) and hospital action, and by the ability of a rural hospital to adapt to its local context, organizing scarce resources in the best manner possible. The implications for quality measurement are:

- Quality measurement systems need to measure the rural hospital's contextual features actionable through public policy, such as personnel availability, so that policy-makers can take action to address the contextual feature that affects quality (e.g., nursing and pharmacist shortages in rural areas).

- Quality measurement systems need to measure the quality of work a rural hospital does with the resources available to it. This means designing measures that will be sensitive to the specific context of each rural hospital. Examples of the latter type of measures are developed more fully below.

Rural Hospital – Community Linkages

Because of their location in smaller communities and the greater likelihood that they are the only hospital in the community, it is easier for rural hospitals to play a key role in organizing community health care. A high quality rural hospital can work with the community to build integrated community care systems and help develop an interdisciplinary team that can fit health care to the local environment. An example is a rural hospital building linkages with local health departments to develop community based care programs or working with local physicians to recruit physicians to the community.

Rural Hospital – Referral Center Linkages

The rural hospital serves as a link between rural residents and urban care facilities, particularly after patient stabilization. This is a consequence both of the rural hospital's location and the more limited range of services it provides. Because of its role in linking residents to urban referral centers, triage-and-transfer decision-making about when to provide a particular type of care, transporting patients, and coordinating information flows to specialists beyond the community are important aspects of rural hospital quality.

Potential problems include specialists beyond the community delaying appointments, inaccurately or incompletely sharing information, and being dismissive of rural practitioners. Implications for quality measurement are:

- A high quality rural hospital will have protocols to guide treatment or referral decisions and develops systems to share information with specialists beyond the community.

- Rural hospitals are difficult to consider as completely contained units for measurement purposes because of the linkages with the community and specialists beyond the community. Care is more likely to be provided in a number of different settings. Measuring quality in rural hospitals can be more difficult because episodes of care may span multiple locations.

Principles for Measuring Rural Hospital Quality

Focus on Conditions and Processes

It was recommended to focus quality measurement on processes and conditions rather than hospital units because measuring conditions and processes captures how well units work together and can measure integration of care across units. Examples of conditions and processes that cross unit boundaries are diabetic care, infectious disease management, antibiotic prescribing, and palliative care. Within conditions, measurement should focus on conditions prevalent in rural hospitals, particularly on points in the care delivery where action could lead to

significant care improvement or error reduction, such as cardiac monitoring processes. An important advantage of process measurement can be its clear linkage to quality improvement efforts.

Careful process selection can support measuring the effectiveness of the provision of a type of service. For example, the measurement of the processes of determining the appropriate type of antibiotic for bacteria, the appropriate patient dosage, monitoring for drug interaction risks, and preparing intravenous drug solutions can assess the overall operation of the pharmacy function.

While measuring at the unit level provides some advantages, they are offset by significant risks. Unit measurement can identify potential problems within "silos," such as surgery and pre- and post-operative care and is consistent with managerial budgeting and evaluation processes. But unit measurement may foster a silo mentality among hospital staff and lead to lower integration across units. Using a functional approach and selecting sets of processes to measure may allow both unit performance and integration to be jointly measured.

Trading Off Breadth and Depth

There is value in measuring broadly, such as a variety of indicators for a particular episode of care for a condition, because it provides an overall measure of quality. But broad measurement is difficult when measures for an episode of care are obtained from multiple sites. This may result in less reliable measurement, particularly when some of the care sites are not within a rural hospital's control. A broad measurement set is best used for episodes of care when a rural hospital has relatively good control of the complete episode of care, such as pneumonia. When a rural hospital has less control over an episode of care, such as acute myocardial

infarction or trauma where the patient is more likely to be stabilized and transferred, using more targeted measures is more appropriate.

Benchmarking, Report Cards and Quality Improvement

Developing a relevant set of measures that apply to most rural hospitals is valuable because it will support benchmarking and comparison across hospitals. If the measures are stable and consistent over time, they can be used to measure and support quality improvement. Relevant measures should be relatively easy to measure and there should be an infrastructure available, such as support from Quality Improvement Organizations (QIOs) and State Offices of Rural Health (SORH), to support rural hospital measurement processes in a timely manner. These measures may be useful for targeting improvement in particular aspects of rural hospital quality that are central to the operation of the hospital, again using the infrastructure and technical assistance available, such as through QIOs and SORH.

Relevant measures should include items that every rural hospital should be doing well. Examples include the proportion of AMI patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival and the proportion of non-neonate pneumonia patients who receive oxygenation assessment with arterial blood gas (ABG) or pulse oximetry within 24 hours of hospital arrival. For comparison purposes and benchmarking, quality measures should be relevant for specific groups of rural hospitals, such as Critical Access Hospitals with less than 25 beds, rural hospitals with 25 to 50 beds, rural hospitals with 50 to 99 beds, etc. because these groups of hospitals may differ significantly in their context and the services they provide.

Measures will vary in their usefulness for report cards as a function of their reliability and comparability across rural hospitals. Measures that are dependent on the specific context of a

hospital will be less useful for report card initiatives such as those currently being sponsored by CMS, AHA and Leapfrog.

Rural Hospital Quality Measurement Gaps

There are a variety of gaps in measuring rural hospital quality in existing hospital quality measurement sets. These gaps involve roles and functions that are important for rural hospitals and include:

- A lack of measures that capture the initial contact role of rural hospitals and their triage and transfer responsibility. Relevant measures could reflect: (a) decision-making and protocol availability and their use in decisions about where to treat a patient (in the local rural hospital or elsewhere); (b) processes for stabilizing and transporting patients; and (c) care integration with referral hospitals and other care delivery systems; and

- A lack of measures that capture linkages within communities. The scarce resource environment in many rural communities requires more integration and coordination to provide effective care and these linkages provide an opportunity for integrating the continuum of care within rural communities. Relevant measures could reflect: (a) the appropriateness of information transfer with other local community providers (e.g. local health department, nursing home); and (b) care integration with other local community providers.

Patient Volume

The low prevalence of many conditions implies that developing reliable measures of rare events (e.g. condition-specific rates, specific procedure volume rates, mortality rates, or post-operative infection rates) is extremely difficult in rural hospitals. The difficulty in obtaining reliable measures suggests that these measures are difficult to use for benchmarking or report cards. It also implies that whole measurement classes, such as those related to volume, may not be precise and reliable enough to be useful for comparisons among rural hospitals.

While low volume makes the construction of some detailed, condition-specific measures unrealistic, the events can still provide useful information. One alternative is identifying these events for root cause analyses and quality improvement efforts. Sharing of this data with similar

rural hospitals may support collaborative learning that improves care delivery. Another alternative is to aggregate measures across conditions (e.g., instead of pneumonia-specific prescribing error rates calculate prescribing error rates across all medical conditions). While the lower precision of the measure may make it less useful for report cards, it could be useful for quality improvement by monitoring time trends within a rural hospital. It also may be useful for benchmarking care processes across hospitals. A final alternative is to aggregate data collection across subgroups of rural hospitals (e.g. those that are members of a network or a system) within a strong organizational relationship. This strategy also can result in collaborative learning that addresses important quality issues within rural hospitals but again may be less useful for report cards.

Summary

While there are some quality measures and measurement issues that are common and important to both rural and urban hospitals, there are also quality measures that are specific to rural hospitals, and quality measures that are more important to rural hospital than urban hospitals. These differences occur because of contextual differences. The major themes for rural hospital differences are:

- Rural hospitals tend to be smaller. This can be advantageous because rural hospital systems are less complex, making it easier to integrate activities and to develop a shared safety culture. This can be a challenge because more specialized resources and technology are less likely to be available. The measurement implication is that measures that can capture quality when care is provided by generalists or by clinicians who encounter a condition intermittently may need to be developed.

- The resource context of a rural hospital is more scarce and diverse than in urban settings. The implication is that rural hospital quality measurement needs to be conditional on its context to be useful and accurate. For example, if a pharmacist is not available around the clock, then one or more of the following needs to be present: 24 hour pharmacy access; regionalized pharmacies; training programs and demonstrated clinical competence of individuals administering drugs; or availability

of a local pharmacist within the community who is linked with the rural hospital care system.

- Rural hospitals have a first-contact and linking role, which means that stabilization and transfer processes have more importance in these facilities than in urban hospitals; and

- Rural hospitals are central, important, and influential organizations in their community. This gives them the opportunity to work with the community to develop integrated care systems.

DEVELOPING QUALITY MEASURES RELEVANT FOR RURAL HOSPITALS WITH LESS THAN 50 BEDS

To identify potential measures of rural hospital quality, we focused on measurement sets from major national organizations or measurement sets that are predominantly used by rural hospitals (see Appendix 2 for a description of the sources used). The national measurement sets include those from the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the National Quality Forum (NQF), the Center for Medicare and Medicaid Services (CMS), and the Agency for Healthcare Research and Quality (AHRQ). Organizations that have developed systems frequently used by rural hospitals for quality measurement include the Rural Wisconsin Health Cooperative (RWHC), Apples to Apples (A2A), the Georgia Hospital Association's Collaborative Approach to Resource Through Effectiveness (CARE), and the Maryland Hospital Association's Quality Indicator Project (Qi Project). There were 346 quality measures contributed from the above eight organizations.

The list of measures considered by the expert panel did not include all of the measures from each of the organizations. Duplicate or similar measures were excluded. For example, some AMI, Heart Failure, Pregnancy, and Community Acquired Pneumonia measures are very similar across measurement systems. For those diagnoses, a generic version of the measures was

included. Additionally, only some of the examples of average length of stay, volume, admission rate, and other types of measures were included.

From the original list of 346 measures, we excluded 58 duplicate measures. The remaining 288 measures was too long a list for the stakeholder panel to review and rate. The measures were sorted into 13 categories, were examined for similarities and compared to the most common types of services, admissions, and procedures in rural hospitals to determine the most appropriate measures for the panel's review. The 13 categories were diagnosis specific, medication management, infection and infection control, surgical complications, emergency room, mortality rates, admission rates, procedure rates, volume, length of stay, employee health, financial, and other. Sixty-eight measures were selected across the 13 categories, including one measure that included several aspects of surgical prophylaxis.

The 13 member expert panel reviewed the list of 68 quality measures prior to their in-person meeting and assessed their relevance for rural hospitals with less than 50 beds based on four criteria:

- the prevalence (of the condition) in small rural hospitals,
- the ease of data collection effort,
- the internal usefulness of the measure for small rural hospitals, and
- the external usefulness for small rural hospitals.

We selected these criteria after reviewing the criteria that various organizations and measurement systems had used in choosing measures. We reviewed the desirable attributes of quality measures as outlined by the National Quality Measures Clearinghouse (NQMC) (National Quality Measures Clearinghouse, 2002), the criteria for choosing process measures as outlined by Eddy (1998), the attributes of core performance measures from JCAHO (Joint Commission on the Accreditation of Healthcare Organizations, 2002), the criteria used in selecting areas for development of performance measures by the NCQA (National Committee on

Quality Assurance, 1998), and the criteria used in identifying the list of safety measures put forth by the Leapfrog Group (Leapfrog Group, 2002). This resulted in a list of potential criteria that included items such as scientific evidence for the underlying concept, risk adjustment, assessment of the data collection effort, statistical properties of the measure (i.e. reliability, validity, comparability, variability), documented effect on population health, financial importance, provider control, and usefulness to consumers, health plans, purchasers, and others. To make maximum use of the expertise of the advisory panel, we focused the criteria on areas that would help to identify those measures that are particularly relevant to rural areas and to eliminate those criteria that are not likely to be useful.

Panel members were asked to rate each of the 68 measures on a five-point Likert scale for each of the four criteria. Panel members returned their ratings via e-mail prior to the in-person meeting and mean ratings were shared with the panel to support their discussion. The ratings by measure and criteria are shown in Appendix 3.

The expert panel recommended that the final set of quality measures selected to be relevant for rural hospitals with less than 50 beds must be useful for internal (e.g. quality improvement) and/or external (e.g. benchmarking, purchaser decisions) purposes. To select measures relevant for quality improvement within a rural hospital, we identified measures that the expert panel rated higher than 4 on the five-point scale for internal usefulness and higher than 3 on the five-point scale for prevalence (or classified as a sentinel event that could lead to serious health consequences). This process identified 20 measures including ten core JCAHO measures related to community acquired pneumonia, heart failure, and AMI; one measure related to infection control; three measures related to medication dispensing and teaching; two procedure-

related measures; two financial measures and two other measures related to the use of advance directives and the monitoring of ER trauma vital signs.[1]

A similar process (that used the external usefulness criterion in place of the internal usefulness criterion) identified 15 measures relevant for external reporting of rural hospital quality. Of note, 14 of the 15 measures on the external usefulness list also were on the above list of 20 measures that were rated to have internal usefulness for rural hospitals.

The combined list of 21 quality measures rated high on internal or external usefulness for rural hospitals with less than 50 beds and high on prevalence were then reviewed by the expert panel. The only change recommended by the panel was the removal from the list of the measure of total pharmaceutical drug costs for the month per inpatient days and outpatient equivalents. After extensive discussion, the panel did not believe this financial indicator was a valid measure of hospital quality. The final list of 20 relevant quality measures for rural hospitals with less than 50 beds, with an indicator of their external and/or internal usefulness, data collection strategy and measurement sources is shown in Table 1. Detailed definitions of the quality measures are provided in Appendix 4.

The above list is a reflection of the value placed by panel members on the different categories of quality measures that may be relevant for rural hospitals. Toward the end of the in-person meeting of the panel, members were asked to rate the value to rural hospitals with less than 50 beds of each of the 13 categories of quality measures described earlier. The ratings were done on a 1 to 4 scale with 1 meaning not at all valuable and 4 meaning extremely valuable. The results are shown in Table 2 and indicate that the categories of quality measures rated most relevant for rural hospitals with less than 50 beds include ER, medication management, diagnosis specific, and infection and infection control and those rated least relevant include surgical

[1] Measures related to non-ER AMI care (i.e. AMI care provided beyond initial treatment) were excluded.

TABLE 1

Quality Measures Relevant for Rural Hospitals With Less Than 50 Beds

Measure	Use Internally, Externally, or Both	Data Collection Strategy	Measurement Sources
1. Proportion of AMI patients with ST elevation on ECG whose time from hospital arrival to thrombolysis is 30 minutes or less.	Both	Chart Review	Apples2Apples (A2A), Rural Wisconsin Health Cooperative (RWHC), JCAHO, Maryland Hospital Association QiProject (MD), Georgia Hospital Association CARE (CARE), National Quality Forum (NQF)
2. Proportion of AMI patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF, Centers for Medicare and Medicaid Services (CMS)
3. Proportion of AMI patients without beta-blocker contraindications who received a beta-blocker within 24 hours after hospital arrival.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF, CMS
4. Proportion of heart failure patients with LVSD, without ACEI contraindications, who are prescribed an ACEI at hospital discharge.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF
5. Proportion of heart failure patients with documentation in the hospital record that LVF was assessed before arrival, during hospitalization, or is planned for after discharge.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF, CMS
6. Proportion of heart failure patients with a smoking history who receive smoking cessation advice or counseling during the hospital stay.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF

Table 1 (continued)

Measure	Use Internally, Externally, or Both	Data Collection Strategy	Measurement Sources
7. Proportion of heart failure patients with documentation that they or their caregivers were given written discharge instructions or other educational material addressing all of the following: 1. Activity level; 2. Diet; 3. Discharge medications; 4. Follow-up appointment; 5. Weight monitoring; 6. What to do if symptoms worsen.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF
8. Proportion of pneumonia patients who received their first dose of antibiotics within 4 hours after hospital arrival.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF, CMS
9. Proportion of non-neonate pneumonia patients who receive oxygenation assessment with arterial blood gas (ABG) or pulse oximetry within 24 hours of hospital arrival.	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF, CMS
10. Proportion of pneumonia inpatients over age 65 who were screened for pneumococcal vaccine status and were not vaccinated due to refusal or contraindication, or needed vaccine and received it prior to discharge	Both	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF, CMS
11. Proportion of pneumonia patients or their caregivers who have history of smoking and who received smoking cessation advice or counseling.	Externally	Chart Review	A2A, RWHC, JCAHO, MD, CARE, NQF

Table 1 (continued)

Measure	Use Internally, Externally, or Both	Data Collection Strategy	Measurement Sources
12. Proportion of surgical patients with appropriate timing and selection of prophylactic antibiotics for procedures. Measures include: 1) antibiotic administration within 1 hour of surgery; 2) antibiotic administration discontinued within 24 hours of surgery; and 3) selection of the appropriate antibiotic. This measure has three parts: timing of pre-operative antibiotic prophylaxis, selection of the appropriate antibiotic and duration of the antibiotic administration.	Both	Chart Review	NQF, A2A, MD
13. Proportion of medication doses reported as medication errors on the hospital variance/incident report. Error is defined as one of the following: wrong patient, wrong dose, wrong time (includes omitted dose), wrong route, and wrong medication. Inclusions: acute care inpatients, inpatient rehab unit patients, observation patients, outpatients, ambulatory surgery patients, swing bed patients, emergency department patients, and urgent care patients; PRN medications. Exclusions: transcribing, prescribing, preparing and dispensing errors that are identified prior to administration.	Internally	Internal Reporting System	RWHC, A2A

Table 1 (continued)

Measures	Use Internally, Externally, or Both	Data Collection Strategy	Measurement Sources
14. Proportion of patients (or their caregivers) with regularly scheduled medications that can demonstrate an understanding of their medication regimen (examples are CHF or diabetic patients).	Both	Internal Reporting System	A2A, RWHC
15. Proportion of discharges that have documented Adverse Drug Reactions for the month (any unwanted or unintended effect).	Internally	Internal Reporting System	A2A
16. Proportion of trauma patients with systolic blood pressure, pulse rate, and respiratory rate documented on arrival to the emergency department and at least hourly for three hours (or until ER patient is released, admitted or transferred).	Internally	Chart Review	A2A
17. Total number of Medicaid denials of admissions and/or continued stays for the month per total Medicaid admissions.	Internally	Administrative Data	A2A
18. Proportion of all births that are delivered by cesarean section.	Both	Administrative Data	Agency for Healthcare Research and Quality (AHRQ), NQF, MD, CARE
19. Number of laparoscopic cholecystectomies per total cholecystectomies.	Internally	Administrative Data	AHRQ, RWHC
20. Proportion of adult admits with complete advance directives for patients 18 years and above, and emancipated minors for the month.	Internally	Chart Review	A2A

TABLE 2

Expert Panel Assessment of Value of Quality Measurement Categories for Rural Hospitals With Less Than 50 Beds

Quality Measurement Category	Mean Rating (St. Dev.) *(1=not at all valuable, 4=extremely valuable)*
Emergency Room	3.64 (0.50)
Medication Management	3.55 (0.52)
Diagnosis Specific	3.45 (0.69)
Infection and Infection Control	3.36 (0.67)
Employee Health	2.82 (0.87)
Financial	2.73 (1.01)
Volume	2.27 (0.79)
Procedure	2.00 (0.63)
Surgical Complications	1.73 (0.79)
Admission Rates	1.45 (0.93)
Length of Stay	1.27 (0.47)
Mortality	1.09 (0.30)

complications, admission rates, length of stay, and mortality. The list of 20 relevant quality measures described above includes 15 measures from the four categories most relevant for rural hospitals with less than 50 beds and no indicators from the four categories rated least relevant.

NEXT STEPS

While rural and urban hospitals share similar types of opportunities and challenges for organizing high quality of care, the relative importance of opportunities and challenges varies as a function of the hospital context. The work completed in this study identified the most relevant quality measures for rural hospitals with less than 50 beds from existing quality measurement systems. In the future, emphasis needs to be placed on developing relevant quality measures for core rural hospital functions (e.g. triage, stabilization and transfer; emergency care; integration of care with other local community providers) not considered in existing measurement sets.[2] The example below discusses in more detail the measurement issues related to the triage, stabilization and transfer process.

Measurement Issues Related to the Triage, Stabilization, and Transfer Process

While triage, stabilization, and transfer are important in all hospitals, they are particularly important in rural hospitals. Because of their size, rural hospitals are less likely to be able to provide more specialized services. Because of their location, individuals needing care may be at a greater distance from a rural hospital and rural hospitals are at a greater distance from facilities with specialized services. This means that decision-making surrounding time-sensitive treatments requiring specialized care may be more difficult. These size and geographic realities increase the importance of organizing triage, stabilization, and transfer in rural hospitals. This suggests that measurement of these processes is an important issue for rural hospitals. Because

[2] The authors appreciate the helpful comments of Kim Bateman, M.D., Medical Director, HealthInsight, on examples of quality measures for core rural hospital functions.

of more limited services, the challenge of managing situations where patients present with conditions that the rural hospital does not have the personnel and facilities to treat takes on increased importance in rural hospitals. Structural measures of the triage, stabilization, and transfer process include the presence of triage and transfer protocols, process measures include the timeliness and appropriateness of transfers (i.e. given the facilities available at the hospital, should a patient have been admitted or transferred; was the transfer decision made in a timely fashion), and outcome measures include patient mortality, as well as patient or caregiver evaluations of involvement in the triage decision.

While measuring triage, stabilization, and transfer decision processes within rural hospitals can reflect what the rural hospital does given patient presentation, it does not capture how quickly the patient presents. Since rural emergency medical services often face economic and geographic constraints, there may be higher fatality rates because of difficulty in getting an emergency patient to a hospital in a timely fashion (Brodsky and Hakkert, 1983). Research suggests that this problem can be addressed with coordinated trauma systems among rural hospitals (Narad, Becker and Frecceri, 1996; Olson et al., 2001). Because of their importance in the local community, rural hospitals have the opportunity to take a leadership role in organizing EMS. This suggests that a useful structural measure of rural hospital quality would be involvement in the development of coordinated trauma systems or integration with local EMS and ambulance services. Useful process measures could include local EMS response time and the communication of a complete set of appropriate patient data from EMS teams to the rural hospital so that the hospital is prepared to treat the arriving patient.

Working with EMS involves the flow of patients to the hospital. The flow of patients to referral centers is equally important during the transfer decision-making process. Because of the

smaller size and catchment volume of rural hospitals, some conditions are likely to present on a relatively rare basis. For these cases, communicating with specialists at referral hospitals is likely to be an important component of the decision-making process, with consultation and information flow being particularly important. Process measures of communication to support the stabilization and transfer decision-making process could measure the quality of communication between the hospitals including the transmission of a complete drug list and transfer note which contains information on patient history, physical and reason for admission to the referral hospital. In addition to patient mortality, outcome measures could include rural physician evaluation of the information exchange process.

Feasibility of Collecting and Using Quality Measurement Data Relevant for Rural Hospitals with Less Than 50 Beds

The ability of rural hospitals to build an infrastructure that supports relevant quality measurement is essential to their future viability. Most rural institutions will need help in their efforts to develop quality measurement systems that are internally useful for clinical staff, management and the board and externally useful for payers, purchasers, and accrediting bodies. This support can be provided by a range of entities including Quality Improvement Organizations, State Offices of Rural Health, state hospital associations, health care systems, and health care networks.

An important next step is to field test the feasibility of collecting and using the set of quality measures relevant for rural hospitals with less than 50 beds. Our study team currently is collaborating with Stratis Health, the QIO for Minnesota, and HealthInsight, the QIO for Utah and Nevada, on an 18-month project funded by CMS to:

- develop measures not included in existing quality measurement sets that are relevant for core rural hospital functions (e.g. triage, stabilization and transfer; emergency care),

- field test the collection of relevant quality measures from a total of 25 to 30 rural hospitals with less than 50 beds in Minnesota, Utah and Nevada, with technical assistance and support from the QIOs on measure specifications and definitions, and data collection tools and protocols, and

- assess strategies for how the above quality measurement data can be used to improve quality for rural Medicare beneficiaries.

Key issues that will be examined in the field test include the ease of data collection, the usefulness of the data for quality improvement within the hospital, and the usefulness of the data for CMS external reporting needs. The ease of data collection is a salient issue given the current efforts of AHA, CMS, NQF and others that encourage and incentivize the measurement of the quality of hospital care. Our study team is developing strategies that: 1) enable individual rural hospitals to collect a subset of the quality measures that are most relevant for their institutions and 2) minimize the number of records necessary for medical record abstraction. We also are encouraging rural hospitals to take full advantage of using quality measures they already are collecting for the current AHA and CMS initiatives. Our goal is to help rural hospitals with less than 50 beds to start building quality measurement capacity in small definable parts, and experience the value of using quality data for internal and external purposes, before they expand the scope and sophistication of their quality measurement system.

REFERENCES

Agency for Healthcare Research and Quality (AHRQ). Healthcare Cost and Utilization Project (HCUP). Available at: http://www.ahrq.gov/data/hcup/. Retrieved April 6, 2003.

American Hospital Association (AHA). "Annual Survey Database – Fiscal Year 2000." Chicago, IL: American Hospital Association, 2001.

Brasure, M., Stensland, J., and Wellever, A. "Quality Oversight: Why Are Rural Hospitals Less Likely to be JCAHO Accredited?" *Journal of Rural Health* 16:324-336, 2000.

Braun, B., Koss, R., and Loeb, J. "Integrating Performance Measure Data into the Joint Commission Accreditation Process." *Evaluation in Health Professions* 22:283-297, 1999.

Brodsky, H. and Hakkert, A. "Highway Fatal Accidents and Accessibility of Emergency Medical Services." *Social Science and Medicine* 17:731-740, 1983.

Brook, R., McGlynn, E., and Cleary, P. "Quality of Health Care. Part 2: Measuring Quality of Care." *New England Journal of Medicine* 335:966-970.

Calico, R., Dillard, C., Moscovice, I., and Wakefield, M. "A Framework and Action Agenda for Quality Improvement in Rural Health Care." *Journal of Rural Health* 19:226-232, 2003.

Campbell, S., Roland, M., and Buetow, S. "Defining Quality of Care." *Social Science & Medicine* 51:1611-1625, 2000.

Coburn, A., Bolda, E., and Keith, R. "Variations in Nursing Home Discharge Rates for Urban and Rural Nursing Facility Residents with Hip Fracture." *Journal of Rural Health* 19:148-155, 2003.

Coburn, A., Keith, R., and Bolda, E. "The Impact of Rural Residence on Multiple Hospitalizations in Nursing Facility Residents." *Gerontologist* 42:661-666, 2002.

Davidson, G. and Moscovice, I. *Rural Hospitals: New Millennium and New Challenges.* Minneapolis, MN: Rural Health Research Center, University of Minnesota, 2003.

Davies, H. and Crombie, I. "Assessing the Quality of Care." *British Medical Journal* 311:766, 1995.

Department of Human Services (DHS). Infection Control – Literature Review: Infection Control and Surveillance Programs (ICSPs). Clinical Governance Section. Available at: http://infectioncontrol.health.vic.gov.au/infcon/icsps.htm#Anchor-Infection-49425. Retrieved August 3, 2003.

Donabedian, A. *Explorations in Quality Assessment and Monitoring. Volume 1: The Definition of Quality and Approaches to Assessment.* Ann Arbor, MI: Health Administration Press, 1980.

Donabedian, A. "The Quality of Care. How Can it be Assessed?" *Journal of the American Medical Association* 260:1743-1748, 1988.

Eddy, D. "Performance Measurement: Problems and Solutions." *Health Affairs* 17:7-25, 1998.

Joint Commission on the Accreditation of Healthcare Organizations (JCAHO). *Attributes of Core Performance Measures and Associated Evaluation Criteria*, 2002. Available at: http://www.jcaho.org/pms/core+measures/attributes+of+core+performance+measures.htm. Retrieved October 18, 2002.

Leapfrog Group. Fact Sheet: The Leapfrog Group, 2002.

McGlynn, E. "Six Challenges in Measuring the Quality of Health Care." *Health Affairs* 16:7-21, 1996.

McGlynn, E. "Selecting Common Measures of Quality and System Performance." *Medical Care* 41:I39-I47, 2003a.

McGlynn, E. "An Evidence-Based National Quality Measure and Reporting System." *Medical Care* 41:I8-I15, 2003b.

McGlynn, E. "Introduction and Overview of the Conceptual Framework for a National Quality Measurement and Reporting System." *Medical Care* 41:I1-I7, 2003c.

Milstein, A., Galvin, R., Delbanco, S., Salber, P., and Buck, C. Jr. "Improving the Safety of Health Care: The Leapfrog Initiative." *Effective Clinical Practice* 3:313-316, 2000.

Moore, J., Jr. "A Welcome Delay. Small Hospitals Applaud JCAHO ORYX Extension." *Modern Healthcare* 28:14-15, 1998.

Moscovice, I. and Rosenblatt, R. "Quality-of-Care Challenges for Rural Health." Journal of Rural Health 16:168-176, 2000.

Narad, R., Becker, J., and Frecceri, C. "A Decentralized Trauma System Design for a Rural Area." *Prehospital Disaster Medicine* 11:134-139; discussion 139-140, 1996.

National Committee on Quality Assurance (NCQA). *Desirable Attributes of HEDIS (R) Measures*, 1998. Available at: http://www.ncqa.org/Programs/HEDIS/desirable%20attributes.html. Retrieved October 22, 2002.

National Quality Forum. "The National Quality Forum Hospital Care National Performance Measures (Group 1)." Washington, DC: The National Quality Forum, 2002.

Needleman, J., Buerhaus, P., Mattke, S., Stewart, M., and Zelevinsky, K. "Nurse-Staffing Levels and the Quality of Care in Hospitals." *New England Journal of Medicine* 346:1715-1722, 2002.

O'Malley, C. "Quality Measurement for Health Systems: Accreditation and Report Cards." *American Journal of Health-System Pharmacy* 54:1528-1535, 1997.

Olson, C., Arthur, M., Mullins, R., Rowland, D., Hedges, J., and Mann, N. "Influence of Trauma System Implementation on Process of Care Delivered to Seriously Injured Patients in Rural Trauma Centers." *Surgery* 130:273-279, 2001.

Shannon, K., Marshall, H., and Coleman, R. "Straight Talk: New Approaches in Healthcare. Working Toward True Excellence: Employers Press for Change." *Modern Healthcare* 32:29-32, 2002.

Shojania, K., Duncan, B., McDonald, K., Wachter, R., and Markowitz, A., (eds.). "Addendum to Summary: Patient Safety Practices Rated by Strength of Evidence." In: *Making Health Care Safer: A Critical Analysis of Patient Safety Practices, Evidence Report/Technology Assessment, No. 43*. Washington, DC: Agency for Healthcare Research and Quality, AHRQ Publication No. 01-E058; 2001.

APPENDIX 1

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APPENDIX 2

Sources for Identifying Rural Hospital Quality Measures

Approach

We identified potential measures of rural hospital quality by examining measurement sets from major national quality organizations and those frequently used by rural hospitals. The national measurement sets include those from the Joint Commission for Accreditation of Healthcare Organizations (JCAHO), the National Quality Forum (NQF), the Centers for Medicare and Medicaid Services (CMS), the Agency for Healthcare Research and Quality (AHRQ), and the American Hospital Association (AHA). Measurement sets frequently used by rural hospitals in response to JCAHO's ORYX initiative include those developed by the Rural Wisconsin Health Cooperative (RWHC), Apples to Apples (A2A), the Georgia Hospital Association's Collaborative Approach to Resource Through Effectiveness (CARE) Program, and the Maryland Hospital Association's Quality Indicator project (QiProject)

To identify the rural oriented quality measurement sets, we started with a list of hospital performance measurement systems that were reported by the administrators of accredited rural hospitals in a previous national survey we completed (Brasure, Stensland, and Wellever, 2000). Two of these, the Rural Wisconsin Health Cooperative and ApplestoApples in Tennessee, were identified in their websites as rural-focused. Maryland's Quality Improvement Project (QiProject) and Georgia's CARE System were chosen because they were the two systems used most frequently by rural hospitals as their ORYX vendor.

Description of National Quality Measurement Systems

Joint Commission on Accreditation of Healthcare Organizations (JCAHO)

JCAHO began development of performance measures in 1987. These activities evolved into the ORYX initiative. Organizations were required to meet accreditation measurement requirements by selecting from among hundreds of performance measurement systems and thousands of performance measures that best served their strategic goals. The large number of systems and measures available made comparisons difficult. The next phase of the ORYX initiative, the development of standardized "Core" measures, permits more rigorous comparisons using standardized, evidence-based measures.

Since 1999, the Joint Commission has solicited input from a variety of stakeholders including clinical professionals, hospitals, consumers, state hospital associations and medical societies on potential focus areas for an initial set of hospital core measures. Once focus areas were identified, advisory panels were convened to identify measures that, when viewed together, permit a robust assessment of the care provided in a given focus area. The Attributes of Core Performance Measures and Associated Evaluation Criteria were used to evaluate candidate measures for potential use as core measures.

Once the initial specifications for the first set of core measures were developed, the Joint Commission initiated a pilot project to test the feasibility, usefulness, and costs associated with the implementation of core measures. The pilot was a collaborative effort among the Joint Commission, five state hospitals associations, five listed measurement systems, and 83 hospitals in nine states. Details related to initial core measure development, and the changes that were made to measures prior to national implementation can be found at History of Core Measure Set Development and Revisions (http://www.jcaho.org/pms/core+measures/cr_hos_cm.htm#1

2/04/03). As of early 2004, JCAHO has 30 core measures in five diagnostic areas – AMI, pregnancy, heart failure, surgical infection prevention and pneumonia.

The Agency for Healthcare Research and Quality (AHRQ)

AHRQ is a federal agency located in the Department of Health and Human Services whose mission is to improve the outcomes and quality of health care, reduce its costs, address patient safety and medical errors, and broaden access to effective services.

AHRQ first developed quality indicators in the early 1990s as part of the Healthcare Cost and Utilization Project (HCUP). The HCUP indicators were based on discharge data from a sample of states nationwide. High frequency areas with high variation were identified and targeted for measurement development. AHRQ's current Quality Indicators (QIs) Project builds on the original HCUP work and is based on the technical review of the UCSF-Stanford Evidence-based Practice Center (Shojania et al., 2000). Based on administrative data, these measures can be used to highlight quality concerns, to identify areas requiring further study, and to track changes over time. There are 71 AHRQ hospital performance measures in three modules: Prevention QIs, Inpatient QIs, and Patient Safety Indicators. The Prevention QIs focus on admissions for ambulatory sensitive conditions that could be prevented by high-quality ambulatory care. The Inpatient QIs measure care that occurs inside of a hospital. These include medical mortality rates, surgical mortality rates, and volume measures. Patient Safety Indicators focus on care inside the hospital that results in surgical complications and other iatrogenic events.

The National Quality Forum (NQF)

NQF is a not-for-profit, public-private partnership proposed by the 1998 report from the President's Advisory Commission on Consumer Protection and Quality in the Health Care

Industry. It was created to develop and implement a national strategy for health care quality measurement and reporting. NQF includes consumers, purchasers and providers. It also has formal relationships with the American Medical Accreditation Program, the Joint Commission on Accreditation of Healthcare Organizations, the National Committee for Quality Assurance (NCQA), and the Institute of Medicine.

NQF has developed a Hospital Care National Performance Measurement Set. All of these measures are in the public domain. At the start of the study, there were 31 measures in eight priority areas, which were approved by the membership in the fall of 2002. This list was expanded to 39 measures that were approved in the Fall of 2003. The measures include condition-specific areas and cross-cutting areas. Cross-cutting topics address aspects of patient care that are not unique to any particular disease or condition. The eight priority areas are acute coronary syndrome, heart failure, pneumonia, pregnancy/childbirth/neonatal conditions, patient safety, pediatric conditions, surgical complications and smoking cessation.

The Centers for Medicare and Medicaid Services (CMS)

The Centers for Medicare and Medicaid Services (CMS) is the federal agency within the Department of Health and Human Services responsible for the Medicare, Medicaid and State Children's Health Insurance programs. CMS has taken an active and collaborative role in the development of quality measures. In 1999, CMS designated four clinical topics (i.e. heart failure, AMI, pneumonia, and stroke) as priorities for hospital-based improvement, as measured by 22 indicators. These topics were selected because they are high volume, high cost conditions for Medicare beneficiaries for which evidence exists that systems and process changes can improve care. QIOs across the country were charged with supporting improvement of these areas in hospitals. In 2002, CMS removed stroke from the list (and from QIO work) and

replaced it with the topic of surgical infection prevention and three associated indicators. The CMS topics and measures align with the JCAHO ORYX measures, and are NQF-endorsed.

CMS endorsed a subset of ten of these measures – in heart failure, AMI, and pneumonia – as part of the American Hospital Association's National Voluntary Public Reporting Initiative (www.hhs.gov/news/press/2002press/20021212.html/); and in November 2003, these same ten measures were designated in the Medicare reform legislation as being linked to hospitals' market basket update for reimbursement purposes.

Description of Quality Measurement Systems Frequently Used By Rural Hospitals

The Rural Wisconsin Health Cooperative (RWHC)

RWHC began as a rural health network organization in 1979. They have been collecting data for quality improvement for thirteen years. Data collection for their measurements include administrative data from UB92 Medicare billing forms and data collected manually from medical records, incident reports, ER department and pharmacy department records.

RWHC uses 16 active measures in addition to the JCAHO Core Measures. Five of the 16 measures are diagnosis specific. Of those, four are obstetrical condition or procedure rates and one is a laparoscopic cholecystectomy rate. The other eleven measures are applicable across most diagnoses and include measures of adverse events such as medication errors and falls, patient education such as insulin preparation, patient autonomy such as use of restraints, and medication management measures such as creatinine clearance monitoring in the elderly. Ninety hospitals in twenty-six states use the RWHC system to meet their ORYX requirements for JCAHO accreditation. Twenty-five of these hospitals are located in Wisconsin.

Apples to Apples (A2A)

A2A started in 1994 as a grassroots effort at three Tennessee hospitals to develop hospital measurements relevant to small rural hospitals. The organization provides benchmarking and data transmission services for rural hospitals. This system is for hospitals licensed for less than 100 beds or hospitals that have an average daily census of less than 100 for the previous calendar year.

In addition to the JCAHO core measures, A2A has 39 measures available. One of these measures is diagnosis specific. The other measures relate to adverse events such as falls and medication errors, poor service delivery, employee health, patient processes such as patient autonomy, screening, and medication management, and administrative statistics related to length of stay and Medicaid denial rate. A2A has 90 members nationwide.

Georgia Hospital Association's Collaborative Approach to Resource Through Effectiveness (CARE) Program

CARE began in 1992 with a grant from the Robert Woodruff Foundation to develop hospital benchmarking. CARE partners with JCAHO and was a pilot site for the JCAHO Core measurement system. Data collection on quality measures began in January of 2001. All of their measures use data contained on the UB92 Medicare billing forms. No manual data collection, such as chart review, is required.

The CARE Program uses 35 hospital measures in 5 categories. These categories are neonatal, obstetrics, surgical site infections, postoperative mortality and mortality. In early 2003, the program had 120 members, with 80 members located in Georgia. Their members include 32 Critical Access Hospitals and 30 small and/or rural hospitals of 50-100 beds.

Maryland Hospital Association's Quality Indicator Project (QiProject)

The QiProject uses 16 broad categories of quality measures with multiple sub-indicators. The broad categories include surgical site infections, prophylaxis for surgical procedures, inpatient mortality, perioperative mortality, management of labor, unscheduled readmissions, unscheduled readmissions following ambulatory procedures, unscheduled returns to intensive care units, unscheduled returns to operating rooms, isolated CABG perioperative mortality, unscheduled returns to the ER, length of stay in the ER, ER x-ray discrepancy and patient management, and cancellation of ambulatory procedures. The QiProject has more than 1,200 members including many state hospital associations. As of early 2003, 95 of the member hospitals had less than 1,500 annual discharges.

APPENDIX 3

Ratings of Potential Quality Measures Relevant for Rural Hospitals With Less Than 50 Beds

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A B=RWHC C=JCAHO D=AHRQ E=NQF F=CMS G=MD H=CARE*
DIAGNOSIS SPECIFIC						
AMI	Proportion of AMI patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival	4.09 (1.3)	3.45 (1.5)	4.31 (1.2)	4.38 (1.2)	A, B, C, E, F, G, H
	Proportion of AMI patients without aspirin contraindications who are prescribed aspirin at hospital discharge	3.70 (1.4)	3.55 (1.6)	4.58 (1.2)	4.54 (1.2)	A, B, C, E, F, G, H
	Proportion of AMI patients with LVSD, without ACEI contraindications, who are prescribed an ACEI at hospital discharge.	3.55 (1.3)	3.00 (1.5)	4.62 (1.1)	4.54 (1.1)	A, B, C, E, F, G, H
	Proportion of AMI patients without beta blocker contraindications who received a beta blocker within 24 hours after hospital arrival.	3.64 (1.3)	3.18 (1.5)	4.62 (1.1)	4.46 (1.1)	A, B, C, E, F, G, H
	Proportion of AMI patients without beta blocker contraindications who are prescribed a beta blocker at hospital discharge.	3.50 (1.1)	3.27 (1.5)	4.54 (1.1)	4.38 (1.2)	A, B, C, E, F, G, H

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
DIAGNOSIS SPECIFIC						
AMI	Proportion of AMI patients with ST elevation on ECG whose time from hospital arrival to per-cutaneous coronary intervention (PCI) is 120 minutes or less	1.56 (1.3)	2.22 (1.1)	2.3 (1.7)	2.91 (1.7)	A, B, C, E, G, H
	Proportion of AMI patients with ST elevation on ECG whose time from hospital arrival to throm-bolysis is 30 minutes or less.	3.60 (1.1)	3.45 (1.4)	4.38 (1.0)	4.23 (1.0)	A, B, C, E, G, H
	Proportion of AMI patients with a history of smoking who receive smoking cessation advice or counseling during their hospital stay.	3.10 (1.5)	2.73 (1.6)	4.08 (1.4)	4.00 (1.4)	A, B, C, E, G, H
Community Acquired Pneumonia	Proportion of non-neonate pneumonia patients who receive oxygenation assessment with arterial blood gas (ABG) or pulse oximetry within 24 hours of hospital arrival.	4.40 (0.7)	4.09 (1.2)	4.83 (0.4)	4.83 (0.4)	A, B, C, E, F, G, H
	Proportion of pneumonia inpatients over age 65 who were screened for pneumococcal vaccine status and were not vaccinated due to refusal or contraindication, or needed vaccine and received it prior to discharge.	3.50 (1.4)	3.20 (1.2)	4.08 (1.1)	4.15 (1.4)	A, B, C, E, F, G, H

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
DIAGNOSIS SPECIFIC						
Community Acquired Pneumonia	Proportion of non-neonate pneumonia inpatients whose blood cultures are collected before the first dose of antibiotic (IV, IM, PO, or NG) is administered in the hospital.	4.40 (0.5)	4.00 (1.1)	4.00 (1.2)	4.00 (1.4)	A, B, C, E, G, H
	Proportion of pneumonia patients who have history of smoking and (or their caregivers) who received smoking cessation advice or counseling.	3.80 (1.2)	3.00 (1.5)	4.00 (1.3)	4.15 (1.3)	A, B, C, E, G, H
	Proportion of pneumonia patients who received their first dose of antibiotics within 4 hours after hospital arrival.	4.40 (0.5)	4.0 (1.1)	4.83 (0.4)	4.85 (0.4)	A, B, C, E, F, G, H
Diabetes	Proportion of inpatients with diabetes DRG 294 or 295 with secondary diagnosis ICD-9 code of 997.0 through 997.99 or 999.0 through 999.9 (complications).	3.67 (1.0)	4.00 (1.2)	3.00 (1.5)	2.75 (1.3)	D
Heart Failure	Proportion of heart failure patients with documentation in the hospital record that LVF was assessed before arrival, during hospitalization, or is planned for after discharge.	3.50 (1.5)	2.82 (1.5)	4.46 (0.8)	4.46 (0.8)	A, B, C, E, F, G, H

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
DIAGNOSIS SPECIFIC						
Heart Failure	Proportion of heart failure patients with LVSD, without ACEI contraindications, who are prescribed an ACEI at hospital discharge.	3.89 (1.2)	3.18 (1.3)	4.92 (0.3)	4.77 (0.4)	A, B, C, E, G, H
	Proportion of heart failure patients with a smoking history who receive smoking cessation advice or counseling during the hospital stay.	3.60 (1.4)	3.27 (1.3)	4.38 (1.0)	4.38 (1.0)	A, B, C, E, G, H
	Proportion of heart failure patients with documentation that they or their caregivers were given written discharge instructions or other educational material addressing all of the following: 1. activity level; 2. diet; 3. discharge medications; 4. follow-up appointment; 5. weight monitoring; 6. what to do if symptoms worsen.	3.70 (1.3)	3.18 (1.3)	4.62 (0.8)	4.31 (1.0)	A, B, C, E, G, H
Pregnancy-related	Proportion of live born infants who expire at the facility within 28 days of birth.	1.78 (1.1)	4.64 (1.2)	3.27 (1.7)	3.09 (1.8)	A, B, C, G, H

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
DIAGNOSIS SPECIFIC						
Pregnancy-related	Proportion of patients with vaginal birth after cesarean delivery – Exclude patients without a previous C-section delivery.	3.00 (0.8)	4.70 (0.7)	4.00 (1.0)	3.91 (0.9)	A, B, C, E, F, G, H
	Proportion of all births in an MSA or county that are low birth weight births (less than 2,500 gms.).	2.10 (0.7)	4.64 (0.7)	3.58 (1.5)	3.58 (1.5)	D
	Proportion of all vaginal deliveries with third or fourth degree perineal laceration (ICD-9-CM principal or other diagnosis code for third or fourth degree perineal laceration).	3.00 (1.4)	4.60 (0.7)	4.00 (1.1)	3.78 (1.1)	A, B, C, D, E, G, H
	Proportion of neonates who receive required immunizations during their inpatient stay (length of stay > 60 days). Required immunizations: DPT, HepB, Polio, Hib, PCV.	1.90 (1.4)	3.89 (1.2)	3.50 (1.5)	3.56 (1.4)	E
	Proportion of live born infants with birth trauma.	2.50 (0.9)	4.38 (0.9)	4.30 (1.1)	3.90 (1.2)	D

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
MEDICATION-RELATED						
	Proportion of discharges that have documented Adverse Drug Reactions for the month. (Any unwanted or unintended effect.)	3.08 (1.4)	2.50 (1.2)	4.62 (0.8)	3.77 (1.2)	A
	Proportion of transfusions that resulted in a reaction per month.	2.00 (0.9)	4.20 (0.9)	4.09 (0.8)	3.92 (1.0)	A, D
	Proportion of medication doses reported as medication errors on the hospital variance/incident report. Error is defined as one of the following: wrong patient; wrong dose; wrong time (includes omitted dose); wrong route; wrong medication. Inclusions: Acute care inpatients, inpatient rehab unit patients, observation patients, outpatients, ambulatory surgery patients, swing bed patients, emergency department patients, and urgent care patients; PRN medications. Exclusions: Transcribing, prescribing, preparing and dispensing errors that are identified prior to administration.	3.73 (1.3)	2.30 (1.4)	4.42 (1.0)	3.67 (1.2)	A, B

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A B=RWHC C=JCAHO D=AHRQ E=NQF F=CMS G=MD H=CARE*
MEDICATION-RELATED						
	Medication Teaching: Proportion of patients (or their caregivers) with regularly scheduled medications who can demonstrate an understanding of their medication regimen. (Examples are CHF or diabetic patients).	3.83 (1.5)	2.18 (0.9)	4.38 (0.8)	4.38 (1.0)	A, B
	Proportion of patients with 9 or more routinely scheduled medications.	3.82 (1.0)	4.00 (1.2)	3.54 (1.0)	3.15 (1.1)	B
	Proportion of inpatients receiving theophylline or digoxin who have no corresponding measured drug level or whose highest measured level exceeds a specific limit.	3.22 (1.2)	3.33 (1.3)	4.00 (1.1)	3.73 (1.3)	A
	Proportion of inpatients 65 years of age or older in whom creatinine clearance has been estimated or measured.	3.55 (1.5)	3.60 (1.3)	4.00 (0.9)	3.27 (1.4)	A

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
INFECTION AND INFECTION CONTROL						
	Proportion of all discharges with infections due to medical care. Cases of secondary ICD-9-CM codes 999.3 or 996.62 per 100 discharges.	2.82 (1.4)	3.90 (1.0)	4.46 (1.0)	4.08 (1.2)	D
	Proportion of all surgical patients with post-op Surgical Site Infections (SSI) for any diagnosis. Any surgery patient with ICD-9 code of 998.59.	2.75 (1.2)	3.36 (0.9)	4.46 (1.0)	4.38 (1.0)	A, D, E, G, H
	Proportion of surgical patients with appropriate timing and selection of prophylactic antibiotics for procedures. Measures include: 1) antibiotic administration within 1-2 hours of surgery; 2) antibiotic administration discontinued within 24 hours of surgery; and 3) selection of the appropriate antibiotic.	3.33 (1.2)	2.91 (1.0)	4.69 (0.5)	4.54 (0.7)	A,E,G

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
OTHER POST OPERATIVE COMPLICATIONS						
	Cases of deep vein thrombosis or pulmonary embolism per 100 surgical discharges.	2.22 (1.3)	3.10 (1.2)	3.67 (0.9)	3.67 (1.0)	D
	Proportion of surgical patients that require an unscheduled return to the OR.	2.10 (1.3)	3.34 (1.1)	4.31 (0.8)	4.15 (1.0)	G
	Cases of a foreign body accidentally left in during a procedure per 100 post-procedure patients.	1.78 (0.7)	3.78 (1.0)	4.09 (1.3)	4.0 (1.3)	D
	Cases of reclosure of post-operative disruption of abdominal wall per 100 cases of abdominopelvic surgery.	1.67 (1.0)	3.78 (1.0)	3.67 (1.2)	3.60 (1.2)	D
	Cases of anesthetic overdose, reaction, or endotracheal tube misplacement per 100 surgery discharges. Excludes codes for drug use or self-inflicted injury.	2.11 (1.1)	2.78 (1.4)	4.11 (1.1)	3.80 (1.0)	A, D

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A B=RWHC C=JCAHO D=AHRQ E=NQF F=CMS G=MD H=CARE*
EMERGENCY ROOM						
	Proportion of trauma patients with systolic blood pressure, pulse rate, and respiratory rate documented on arrival to the emergency department and at least hourly for three hours (or until ER patient is released, admitted or transferred).	3.90 (1.0)	3.55 (1.2)	4.08 (1.1)	3.85 (1.1)	A
	Proportion of unique ER patients with unplanned returns to ER within 48 hours for the month.	2.90 (0.9)	3.70 (0.7)	4.00 (1.0)	3.50 (1.4)	A, B, G
	Proportion of ER visits that resulted in the patient leaving (Left Against Medical Advice) per month.	2.00 (1.0)	4.22 (0.7)	3.50 (1.1)	2.80 (1.1)	A
	Proportion of all ER visits where the patient left prior to physician evaluation for the month.	2.13 (1.1)	4.00 (0.9)	4.09 (0.8)	3.00 (0.9)	A

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
EMERGENCY ROOM						
	Proportion of all emergency room cases that required x-ray services where a discrepancy between the initial and final x-ray reports required a clinically significant adjustment in patient management. Inclusions: All patients registered as Emergency Room patients; All Emergency Room cases where a discrepancy between the initial physician report and the final radiologist report required that a patient be contacted for a change in treatment. Clinically significant adjustment in patient management requires hospital contact with the patient, provider's office, or caregiver. Exclusions: All patients registered as Urgent Care patients; Any cases where the patient is called back for an additional x-ray that confirms the initial interpretation; CT, Ultrasound and Nuclear Medicine studies.	2.78 (1.6)	2.60 (1.1)	4.42 (0.8)	3.58 (1.2)	B, G

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
EMERGENCY ROOM						
	Proportion of all ER cases that were in ER >6 hours.	2.20 (0.9)	4.00 (0.9)	3.82 (1.5)	3.09 (1.4)	G
	Proportion of physicians contacted for the month from the ER who did not respond within 30 minutes of notification for the month. These are those physicians who are not in house and are called in on a consultative basis (e.g. surgeons, other specialists).	2.50 (1.2)	3.50 (1.1)	4.50 (0.7)	3.60 (0.8)	A
MORTALITY RATES						
	Proportion of all AMI patients with a discharge code of expired.	2.30 (1.3)	4.83 (0.6)	3.77 (1.3)	3.62 (1.4)	A, B, C, D, E, G, H
	Proportion of all patients who received anesthesia with a discharge code of expired.	2.00 (1.1)	4.90 (0.3)	3.55 (1.6)	3.09 (1.5)	H
	Proportion of general medicine patients with discharge code of expired.	2.88 (1.0)	4.90 (0.3)	3.55 (1.4)	2.82 (1.3)	H
	Proportion of all liveborns who expire at the facility within 28 days of birth.	1.64 (0.8)	4.80 (0.6)	4.00 (1.1)	3.50 (1.2)	E

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A B=RWHC C=JCAHO D=AHRQ E=NQF F=CMS G=MD H=CARE*
ADMISSION RATES						
	Proportion of all COPD patients who are readmitted within 180 days for DRG 088 (COPD).	3.25 (0.9)	3.70 (0.9)	3.91 (1.3)	3.55 (1.4)	D
	Number of admissions for bacterial pneumonia per 100,000 population in the MSA or county.	2.75 (1.3)	3.82 (1.3)	3.25 (1.6)	3.00 (1.7)	D
	Number of admissions with principal diagnosis of asthma in adults per 100,000 population in the MSA or county.	2.56 (1.0)	2.11 (0.7)	3.42 (1.3)	3.33 (1.4)	D
PROCEDURE RATES						
	Proportion of all births that are delivered by cesarean section.	3.10 (1.0)	4.75 (0.5)	4.36 (0.8)	4.25 (0.9)	D, E, G, H
	Number of laparoscopic cholecystectomies per 100 cholecystectomies.	3.57 (1.1)	4.63 (0.5)	4.13 (0.8)	3.67 (1.2)	B, D
VOLUME						
	PTCA raw volume compared to annual thresholds (200, 400 procedures).	1.0 (0.0)	4.18 (1.6)	3.10 (1.4)	3.30 (1.3)	D

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A B=RWHC C=JCAHO D=AHRQ E=NQF F=CMS G=MD H=CARE*
LENGTH OF STAY						
	Average LOS in days for all patients with ICD-9 code 789.00, abdominal pain, unspecified site.	2.67 (1.0)	4.45 (0.8)	3.40 (1.3)	3.20 (1.1)	A
EMPLOYEE HEALTH						
	Total number of employee needle sticks for the month per FTE worked.	2.33 (1.0)	4.10 (1.2)	4.62 (0.7)	3.54 (1.5)	A
	Total number of employee back injuries for the month per FTE worked.	2.56 (0.9)	4.00 (1.1)	4.31 (0.9)	3.17 (1.6)	A
FINANCIAL						
	Total pharmaceutical drug cost for the month per inpatient days and outpatient equivalents. (Does not include salary cost).	3.33 (1.2)	3.38 (0.9)	4.33 (1.0)	3.20 (1.6)	A
	Total number of denials, admissions and/or continued stays for the month per total Medicaid admissions.	3.29 (1.1)	3.57 (1.0)	4.38 (0.7)	3.83 (1.2)	A
OTHER MEASURES						
	Proportion of all admissions developing Stage II decubitus and/or increasing present decubitus to a Stage II or greater for the month.	2.44 (1.3)	3.50 (1.1)	4.50 (0.9)	3.50 (1.3)	A, D

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A E=NQF B=RWHC F=CMS C=JCAHO G=MD D=AHRQ H=CARE*
OTHER MEASURES						
	Proportion of all patients with falls for the month. This includes inpatients, outpatients, emergency room and observations. Includes assists to the floor.	2.80 (1.2)	3.73 (0.8)	4.69 (0.6)	4.15 (0.9)	A, B
	Proportion of inpatients with physical restraint orders. (NUMBER OF PATIENTS, NOT NUMBER OF ORDERS.) *A physical restraint is any device used for the purpose of preventing or limiting free mobility. This excludes devices, which are documented as being used for the purpose of improving posture, facilitating positioning or enabling the patient to achieve increased function. Postural, positioning and enabling devices which restrict freedom of movement, in patients who have the ability to stand or ambulate, must be counted as restraints*	2.00 (0.9)	3.40 (0.8)	4.33 (0.8)	3.83 (0.7)	A, B

		Mean Scores (St. Deviation)				
Type of Measure	**Description of Measure**	**Prevalence in rural hospitals < 50 beds** *(1=not prevalent, 5=very prevalent, 9=don't know)*	**Ease of data collection effort in rural hospitals < 50 beds** *(1=very difficult, 5=very easy, 9=don't know)*	**Internal usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**External usefulness for rural hospitals < 50 beds** *(1=not at all useful, 5=very useful, 9=don't know)*	**Sources** *A=A2A B=RWHC C=JCAHO D=AHRQ E=NQF F=CMS G=MD H=CARE*
OTHER MEASURES						
	Proportion of adult admits with incomplete advance directives for patients 18 years and above, and emancipated minors for the month.	3.90 (0.9)	4.00 (0.7)	4.18 0.8	3.70 0.9	A
	Deaths per 100 patients having developed specific complications of care during hospitalization.	2.20 0.8	2.75 1.2	4.4 0.7	3.89 1.3	D
	Cases of iatrogenic pneumothorax per 100 discharges.	1.13 0.4	3.11 1.5	3.20 1.4	3.13 1.2	D
	Proportion of patients and/or caregivers participating in the development of therapy goals. Inclusions: All inpatients and outpatients receiving physical therapy, occupational therapy and/or speech therapy. Exclusions: Patients who discontinue therapy services before goal development.	4.00 1.1	2.89 1.5	3.91 0.9	3.40 1.3	B

APPENDIX 4

Definitions of Quality Measures Relevant for Rural Hospitals With Less Than 50 Beds

Measure	Numerator	DENOMINATOR
1. Proportion of AMI patients with ST elevation on ECG whose time from hospital arrival to thrombolysis is 30 minutes or less.	Number of patients with a time from hospital arrival to thrombolysis of 30 minutes or less.	AMI patients without thrombolysis contraindications. Included Populations: discharges with an ICD-9 Code for AMI of 410. Excluded Populations: patients less than 18 years of age; received in transfer from another hospital including another emergency department; patients discharged on day of arrival, who expired on day of arrival or who left against medical advice on day of arrival.
2. Proportion of AMI patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival.	AMI patients who received aspirin within 24 hours before or after hospital arrival.	AMI patients without aspirin contraindications. Included Populations: discharges with an ICD-9 Code for AMI of 410. Excluded Populations: patients less than 18 years of age; received in transfer from another hospital including another emergency department; patients discharged on day of arrival, who expired on day of arrival or who left against medical advice on day of arrival.
3. Proportion of AMI patients without beta-blocker contraindications who received a beta-blocker within 24 hours after hospital arrival.	AMI patients who received a beta blocker within 24 hours after hospital arrival.	AMI patients without beta blocker contraindications. Included Populations: discharges with an ICD-9 Code for AMI of 410. Excluded Populations: patients less than 18 years of age; transferred to another acute care hospital on day of arrival; received in transfer from another acute care hospital on day of arrival, including another emergency department; discharged on day of arrival, who expired on day of arrival or who left against medical advice on day of arrival.
4. Proportion of heart failure patients with LVSD, without ACEI contraindications, who are prescribed an ACEI at hospital discharge.	Heart failure patients who are prescribed an ACEI at hospital discharge.	Heart failure patients with LVSD and without ACEI contraindications. Included Populations: discharges with an ICD-9 Code for heart failure of 402, 404, 428+K23 and chart documentation of a LVEF less than 40% or a narrative description of LVF consistent with moderate or severe systolic dysfunction. Excluded Populations: patients less than 18 years of age; transferred to another acute care hospital; who expired; who left against medical advice; discharged to hospice; with chart documentation of participation in a clinical trial testing alternatives to ACEIs as first-line heart failure therapy.

APPENDIX 4 (continued)

Measure	Numerator	Denominator
5. Proportion of heart failure patients with documentation in the hospital record that LVF was assessed before arrival, during hospitalization, or is planned for after discharge.	Heart failure patients with documentation in the hospital record that LVF was assessed before arrival, during hospitalization, or is planned for after discharge.	Heart failure patients. Included Populations: discharges with an ICD-9 Code for heart failure of 402, 404, 428. Excluded Populations: patients less than 18 years of age; transferred to another acute care hospital; who expired; who left against medical advice; discharged to hospice; with reasons documented by a physician, nurse practitioner, or physician assistant for no LVF assessment.
6. Proportion of heart failure patients with a smoking history who receive smoking cessation advice or counseling during the hospital stay.	Heart failure patients who receive smoking cessation advice or counseling during the hospital stay.	Included Populations: discharges with an ICD-9 Code for heart failure of 402, 404, 428 and a history of smoking cigarettes anytime during the year prior to hospital arrival. Excluded Populations: patients less than 18 years of age; transferred to another acute care hospital; who expired; who left against medical advice; discharged to hospice.
7. Proportion of heart failure patients with documentation that they or their caregivers were given written discharge instructions or other educational material addressing all of the following: 1) Activity level; 2) Diet; 3) Discharge medications; 4) Follow-up appointment; 5) Weight monitoring; 6) What to do if symptoms worsen.	Heart failure patients with documentation that they or their caregivers were given written discharge instructions or other educational material addressing all of the following: 1) Activity level; 2) Diet; 3) Discharge medications; 4) Follow-up appointment; 5) Weight monitoring; 6) What to do if symptoms worsen.	Heart failure patients discharged home. Included Populations: an ICD-9 Code for heart failure of 402, 404, 428 and a discharge to home, home care, or home IV therapy. Excluded Populations: patients less than 18 years of age.
8. Proportion of pneumonia patients who received their first dose of antibiotics within 4 hours after hospital arrival.	Number of pneumonia patients who received their first dose of antibiotics within 4 hours after hospital arrival.	Principal diagnosis ICD-9-CM code of 480.0-483.8, 485-486, (pneumonia) or 487.0 (influenza with pneumonia); or a principal diagnosis ICD-9-CM code of 038.XX (septicemia) or 518.81 (respiratory failure) and a secondary diagnosis code of pneumonia. A principal diagnosis code 518.84 (acute & chronic respiratory failure) can be added to 518.81.

APPENDIX 4 (continued)

Measure	Numerator	Denominator
9. Proportion of non-neonate pneumonia patients who receive oxygenation assessment with arterial blood gas (ABG) or pulse oximetry within 24 hours of hospital arrival.	Pneumonia patients who receive oxygenation assessment with arterial blood gas (ABG) or pulse oximetry within 24 hours of hospital arrival.	Inpatients age 29 days and older with an ICD-9 Code for pneumonia of 480-483.8, 485-486, or 487 or an ICD-9 Code for septicemia of 038.xx and an ICD-9 Code for pneumonia or ICD-9 Code for respiratory failure of 518.81 and an ICD-9 Code for pneumonia. Excluded Populations: patients received in transfer from another acute care hospital; who have no working diagnosis of pneumonia at the time of admission; receiving "palliative care" in the medical community and "comfort care" by the general public.
10. Proportion of pneumonia inpatients over age 65 who were screened for pneumococcal vaccine status and were not vaccinated due to refusal or contraindication, or needed vaccine and received it prior to discharge.	Number of pneumonia inpatients who were screened for vaccine status and were not vaccinated due to refusal or contraindication, or needed vaccine and received it prior to discharge.	Inpatients 65 years of age and older with an ICD-9 Code for pneumonia of 480-483.8,485-486, or 487 or an ICD-9 Code for septicemia of 038.xx and an ICD-9 Code for pneumonia or ICD-9 Code for respiratory failure of 518.81 and an ICD-9 Code for pneumonia. Excluded Populations: patients received in transfer from another acute care hospital; who left against medical advice; who have no working diagnosis of pneumonia at the time of admission; receiving "palliative care" in the medical community and "comfort care" by the general public.
11. Proportion of pneumonia patients or their caregivers who have history of smoking and who received smoking cessation advice or counseling.	CAP patients who receive smoking cessation advice or counseling during the hospital stay.	CAP patients with a history of smoking cigarettes anytime during the year prior to arrival. An ICD-9 Code for pneumonia of 480.0-483.8, 485-486 or 487.0 or an ICD-9 Code for septicemia of 038.xx and an ICD-9 Code for pneumonia or ICD-9 Code for respiratory failure of 518.81 and an ICD-9 Code for pneumonia and patients who have a history of smoking cigarettes within the year prior to admission. Excluded Populations: patients transferred to another acute care hospital; who left against medical advice; discharged to hospice; who expired; who have no working diagnosis of pneumonia at the time of admission; receiving "palliative care" in the medical community and "comfort care" by the general public.

APPENDIX 4 (continued)

Measure	Numerator	Denominator
12. Proportion of surgical patients with appropriate timing and selection of prophylactic antibiotics for procedures. Measures include: 1) antibiotic administration within 1 hour of surgery; 2) antibiotic administration discontinued within 24 hours of surgery; and 3) selection of the appropriate antibiotic. This measure has three parts: timing of pre-operative antibiotic prophylaxis, selection of the appropriate antibiotic and duration of the antibiotic administration.	1) Number of surgical patients who received prophylactic antibiotics within 1 hour of surgical incision. 2) Number of eligible patients who received recommended prophylactic antibiotics for specific surgical procedures (see table at the end of Appendix 4). 3) Number of eligible surgical patients whose prophylactic antibiotics were discontinued within 24 hours after surgery end time.	Number of surgical patients with: CABG (ICD-9-CM procedure codes 36.10-36.14, 36.19, 36.15-36.17, 36.2), other cardiac surgery (35.0-35.95, 35.98, 35.99), colon surgery (45.00, 45.03, 45.41, 45.49, 45.50, 45.7-45.90, 45.92-45.95, 46.03, 46.04, 46.1-46.14, 46.43, 46.52, 46.75, 45.76, 46.91, 46.92, 46.94, 48.5, 48.6-48.69), hip arthroplasty (81.51, 81.52), knee arthroplasty (81.54), abdominal hysterectomy (68.3, 68.4, 68.6), vaginal hysterectomy (68.5-68.59, 68.7), or vascular surgery (38.34, 38.36, 38.37, 38.44, 38.48, 38.49, 38.51, 38.52. 38.64, 38.14, 38.16, 38.18, 39.25, 39.26, 39.29).
13. Proportion of medication doses reported as medication errors on the hospital variance/incident report. Error is defined as one of the following: wrong patient; wrong dose; wrong time (includes omitted dose); wrong route; wrong medication. Inclusions: acute care inpatients, inpatient rehab unit patients, observation patients, outpatients, ambulatory surgery patients, swing bed patients, emergency department patients, and urgent care patients; PRN medications. Exclusions: transcribing, prescribing, preparing and dispensing errors that are identified prior to administration.	Total number of medication errors as reported on the hospital variance/incident report. Error is defined as one of the following: wrong patient; wrong dose; wrong time (includes omitted dose); wrong route; wrong medication. Inclusions: acute care inpatients, inpatient rehab unit patients, observation patients, outpatients, ambulatory surgery patients, swing bed patients, emergency department patients, and urgent care patients; PRN medications. Exclusions: transcribing, prescribing, preparing and dispensing errors that are identified prior to administration.	Total number of doses of medication dispensed. Inclusions: acute care inpatients, inpatient rehab unit patients, observation patients, outpatients, ambulatory surgery patients, swing bed patients, emergency department patients, and urgent care patients; dose of PRN medications dispensed and administered. Exclusions: dose dispensed from pharmacy but not administered due to change in med orders, patient discharge and/or death.

APPENDIX 4 (continued)

Measure	Numerator	Denominator
14. Proportion of patients (or their caregivers) with regularly scheduled medications who can demonstrate an understanding of their medication regimen (examples are CHF or diabetic patients).	Total number of patients and/or caregivers who state the schedule of medications. Inclusions: all patients with any prescribed home medications; new and/or existing prescriptions; inpatients, swing bed patients, ambulatory care patients and patients seen in ER. Exclusions: patients without medications taken on a routine scheduled basis; patients with meds to be taken as needed, PRN only.	Total number of patients with medications to be taken on a routine, scheduled basis. Inclusions: all patients with any prescribed home medications; new and/or existing prescriptions; inpatients, swing bed patients, ambulatory care patients and patients seen in ER. Exclusions: patients without medications taken on a routine scheduled basis; patients with medications to be taken as needed, PRN only.
15. Proportion of discharges that have documented Adverse Drug Reactions for the month (any unwanted or unintended effect).	Total number of inpatients that have documented ADRs for the month (any unwanted or unintended effect).	Total number of admissions (inpatients) for the month.
16. Proportion of trauma patients with systolic blood pressure, pulse rate, and respiratory rate documented on arrival to the emergency department and at least hourly for three hours (or until ER patient is released, admitted or transferred).	Trauma patients with systolic blood pressure, pulse rate, and respiratory rate documented on arrival to the emergency department and at least hourly for three hours (or until ER patient is released, admitted or transferred).	All trauma patients (i.e. patients undergoing emergency hospital care for at least one of the diagnoses listed on ICD-9-CM codes 800-999, General Trauma Codes AND who were admitted, transferred or expired).
17. Total number of Medicaid denials of admissions and/or continued stays for the month per total Medicaid admissions.	Total number of Medicaid denials of admissions and/or continued stays for the month.	Total number of Medicaid admissions for the month.
18. Proportion of all births that are delivered by cesarean section.	Number of cesarean sections.	All deliveries.

APPENDIX 4 (continued)

Measure	Numerator	Denominator
19. Number of laparoscopic cholecystectomies per total cholecystectomies.	Number of laparoscopic cholecystectomies.	All discharges with any procedure code of cholecystectomy in any field. Include only discharges with uncomplicated cases (i.e., cholecystitis or cholelithiasis in any diagnosis field).
20 Proportion of adult admits with complete advance directives for patients 18 years and above, and emancipated minors for the month.	Total number of complete advance directives for patients 18 years and above, and emancipated minors for the month.	Total number of applicable inpatient admissions (i.e. excluding pediatrics) for the month.

Recommended Prophylactic Antibiotics
(Selection of antibiotic administration for surgical patients)

Surgical Procedure	Approved Antibiotics
Cardiac	Cefazolin or Cefuroxime or Cefamandole or Vancomycin*
Vascular	Cefazolin or Cefuroxime or Cefamandole or Vancomycin* or Clindamycin*
Hip/Knee Arthroplasty	Cefazolin or Cefuroxime or Vancomycin*
Colon	Oral: after effective mechanical bowel preparation, Neomycin sulfate + Erythromycin base or Neomycin sulfate + Metronidazole Administered for 18 hours preoperatively. Parenteral: Cefoxitin or Cefotetan or Cefmetazole or Cefazolin + Metronidazole or Fluoroquinolone + Clindamycin*
Hysterectomy	Cefazolin or Cefotetan or Cefoxitin or Cefuroxime or Fluoroquinolone + Clindamycin*
* *Special Considerations*	For cardiac, orthopedic, and vascular surgery, if the patient is allergic to β-lactam antibiotics, vancomycin is an acceptable substitute. Clindamycin is also considered an acceptable substitute for non-cardiac vascular surgery. For colon surgery or hysterectomy, if the patient is allergic to β-lactam antibiotics, then a fluoroquinolone + clindamycin is an acceptable substitute.