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Patient Assessments and Quality of Care in Rural Hospitals

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EXECUTIVE SUMMARY

Purpose

The purpose of this project is to: 1) analyze the relationship between patients' perspectives of hospital quality of care and key hospital characteristics that may influence patients' experiences of hospital care, including rurality; and 2) assess whether patients' perspectives of hospital quality of care are related to quality measures focused on the provision of recommended care for medical conditions.

Methods

The study uses CMS Consumer Assessment of Health Providers and Systems Survey (HCAHPS) data and Hospital Compare process measure data linked with data on hospital characteristics from the American Hospital Association (AHA) Annual Survey, and data on Critical Access Hospitals (CAHs), small rural hospitals with 25 or fewer beds, from a database maintained by the Flex Monitoring Team.[i]

The HCAHPS survey items address communication with doctors, communication with nurses, responsiveness of hospital staff, cleanliness and quietness of hospital environment, pain management, communication about medicines, discharge information, an overall rating of the hospital, and a rating of willingness to recommend the hospital. The survey also includes demographic items.

This study uses ordered logistic regression models to examine the relationships between each of the HCAHPS measures and key hospital characteristics. Regression models are also used to examine the relationships between the two summary HCAHPS measures, the overall hospital rating and the patient recommendation of the hospital measure, and the composite inpatient process of care measures for AMI, heart failure, pneumonia, and an aggregate process of care composite score.

Results and Conclusions

Hospitals in rural areas have significantly higher ratings on HCAHPS measures than those located in urban areas. Within rural areas, hospitals in less densely populated rural areas (non-core) have significantly higher scores than those in more densely populated (micropolitan) areas. After controlling for hospital organizational factors, including hospital size and staffing, the differences by rurality remain significant for all the HCAHPS measures except the patient recommendation of hospital measure.

[i] The Flex Monitoring Team is a partnership of the Rural Health Research Centers and the Universities of Minnesota, North Carolina-Chapel Hill, and Southern Maine. Through a cooperative agreement award from the Federal Office of Rural Health Policy, the Team monitors the Medicare Rural Hospital Flexibility Grant Program, including tracking the number and characteristics of CAHs. See www.flexmonitoring.org for additional information.

Among the hospital organizational factors, for-profit status and hospital inpatient volume tend to have the largest effects on HCAHPS scores. For-profit status has a significant negative effect on all HCAHPS measures except one (whether the patient room's was quiet at night). Hospital inpatient volume has a significant negative effect on all HCAHPS measures. The negative relationship between for-profit ownership and the HCAHPS measures is consistent with previous research, which found a negative relationship between for profit status and the overall hospital rating. However, the size of the effect is surprisingly large relative to other hospital organizational characteristics.

Nursing and pharmacist staffing variables have smaller, significant positive effects on several measures. The registered nurse FTE per adjusted patient day variable has a significant positive impact on the nurse communication, receiving help as soon as needed, pain control, and medication explanation measures. The total nursing FTE (including RNs, LPNs and Nursing Assistants) per adjusted patient day variable has a significant positive effect on the discharge information, overall rating and recommendation measures. The RN percentage of total nursing staff FTEs variable has a significant positive effect on the discharge information, overall rating and recommendation measures. In alternative models for the pain control and medication explanation measures that do not include RN staffing (because of the high correlation between RN and pharmacist staffing), the pharmacist FTEs per adjusted patient day variable has significant positive effects.

Other organizational characteristic variables have a small effect on some HCAHPS measures. Teaching hospital status has a small positive effect on the physician communication measure while using hospitalists has a small but significant negative effect. The number of hospitals in the service area has a small positive effect on the overall rating and recommendation measures.

The heart failure and pneumonia process of care composite measures have a statistically significant impact on the HCAHPs overall rating and recommendation scores; the AMI composite measure does not. For both the overall hospital rating and the hospital recommendation models, the effect sizes for the pneumonia and heart failure composite scores are reasonably strong, considering that these individual conditions represent small subsets of inpatients.

The aggregate process of care composite score, which combines the AMI, heart failure and pneumonia process of care composite scores, has a larger and more significant impact on HCAHPS scores than the individual composite measures. However, its effect size is still smaller than the effect sizes for some of the organizational characteristic variables in the previous models (e.g., size and for-profit ownership).

The overall better performance of smaller, rural hospitals on the HCAHPS measures contrasts with their generally lower overall performance on the process of care measures, especially the AMI and heart failure measures, relative to larger urban hospitals. These differences in performance suggest that the process of care measures and the HCAHPS measures are measuring different aspects of quality.

Future Research

Future research should examine changes in the number of hospitals reporting HCAHPS data, particularly CAHs, which are currently publicly reporting on a voluntary basis without the financial incentive PPS hospitals have for reporting. Given the differences in characteristics of reporting and non-reporting hospitals, it will be important to analyze whether HCAHPS scores change over time and how those changes are related to hospital characteristics. It will also be important to identify which hospitals are successfully improving their HCAHPS scores and how they are doing it, so that other hospitals may learn from them.

INTRODUCTION AND PURPOSE OF PROJECT

The national focus on health care quality and patient safety has resulted in increased attention to patients' assessments of their experiences receiving health care. Patient-centered care is one of the Institute of Medicine's six aims for the health care system.[1] The results of patient satisfaction surveys can be used in conjunction with other quality measures to evaluate the quality of hospital care and identify areas for quality improvement.

The purpose of this project is to: 1) analyze the relationships between patients' perspectives of hospital quality of care and key hospital characteristics that may influence patients' experiences of hospital care, including rurality; and 2) assess whether patients' perspectives of hospital quality of care are related to quality measures focused on the provision of recommended care for medical conditions.

BACKGROUND AND REVIEW OF THE LITERATURE

It has been suggested that patient perceptions of quality are important for two reasons: 1) they are inherently meaningful and should be a primary focus of attention within the health care system, and 2) they are powerful drivers of patient choice of plan or provider, patient adherence to medical advice, patient complaints and grievances, the level and seriousness of malpractice claims, and actual health and functional status outcomes.[2]

The hospital version of the Consumer Assessment of Health Providers and Systems Survey, HCAHPS, was developed by the Agency for Healthcare Research and Quality (AHRQ) and the Centers for Medicare and Medicaid Services (CMS) to provide a uniform set of measures that complement other hospital survey tools designed to support quality improvement.[3-4] CMS has three broad goals for the HCAHPS survey initiative: 1) to provide comparable data on patients' perspectives of care that allows objective and meaningful comparisons among hospitals; 2) to create incentives for hospitals to improve the quality of care; and 3) to enhance public accountability in health care through public reporting.[5]

The HCAHPS survey includes 18 items that address communication with doctors, communication with nurses, responsiveness of hospital staff, cleanliness and quietness of hospital environment, pain management, communication about medicines, discharge information, an overall rating of the hospital, and a rating of willingness to recommend the hospital. The survey also includes demographic items. Hospitals may use HCAHPS as a stand-alone survey or in combination with hospital-specific items to support internal patient satisfaction and quality-related activities. The survey is designed to be administered to adult patients, 18 years and older, who had an inpatient overnight stay in a short-term, acute care hospital for a non-psychiatric primary diagnosis. Hospitals can choose to conduct the survey in one of four modes: mail, telephone, mail with telephone follow-up, or interactive voice recognition; they may use a survey vendor that has been approved by CMS or collect their own data if they are qualified.[5]

The HCAHPS survey has undergone extensive field testing. Analysis of results from 132 hospitals that pilot-tested the survey to assess the impact of patient characteristics on HCAHPS ratings found that the most important case-mix variables were: type of hospital service (surgery, obstetric, medical), age, race (non-Hispanic black), education, general health status, speaking Spanish at home, having a circulatory disorder, and interactions of each of these variables with type of hospital service.[6] A total of 1,313 hospitals voluntarily submitted their HCAHPS data to the AHRQ CAHPS Benchmarking Database in 2007.[7] Hospitals across the country submitted data, although smaller hospitals (those with less than 50 beds) were under-represented.

Hospitals paid under the Medicare Prospective Payment System (PPS) were required to submit HCAHPS data starting with the 4th quarter of 2006, along with the other Hospital Compare quality measures, in order to receive their full annual payment update from Medicare. The HCAHPS data was first publicly reported on the CMS Hospital Compare website in March 2008. However, PPS hospitals were allowed to suppress their data from the website until March 2009. Critical Access Hospitals (CAHs) may voluntarily submit HCAHPS data for public reporting.

The HCAHPS survey items address communication with doctors, communication with nurses, responsiveness of hospital staff, cleanliness and quietness of hospital environment, pain management, communication about medicines, discharge information, an overall rating of the hospital, and a rating of willingness to recommend the hospital (Figure 1).

CMS adjusts the HCAHPS results for mode effects (e.g., whether the survey was conducted by mail, telephone, mail with telephone follow-up or active interactive voice recognition), the hospital's response rate, and patient mix variables, including type of hospital service line (surgery, obstetric, medical), health status, education, age, admission through the Emergency Room, speaking a language other than English at home, and an age by service line interaction.[8]

AHRQ chartbooks provide voluntarily reported HCAHPS results by hospital organizational characteristics such as region, bed size, teaching status, ownership and control. In the 2008 chartbook, small hospitals with less than 50 beds had a higher percent of "always" responses than medium and large hospitals for all of the measures except for the willingness to recommend question; on that measure, both small hospitals and large hospitals scored higher than medium size hospitals.[7,9]

Three recent articles used publicly reported HCAHPS data from the CMS Hospital Compare website to examine hospital quality issues. Jha et. al found that the percentage of patients that gave an overall hospital rating of 9 or 10 varied significantly as a function of several hospital characteristics, including the ratio of nurses to patient days, profit status, location, size, presence of a medical intensive care unit, and volume of Medicaid patients.[10] Hospitals with less than 100 beds, those with higher nurse staffing ratios, not-for-profit or public status, and rural location had higher percentages of patients with a 9 or 10 overall rating. Hospitals with a medical ICU and those with a

Figure 1
HCAHPS Measures and Survey Questions

HCAHPS Measure	Questions on HCAHPS Survey
How often did nurses communicate well with patients? Always Usually Sometimes/never	During this hospital stay… • how often did nurses treat you with courtesy and respect? • how often did nurses listen carefully to you? • how often did nurses explain things in a way you could understand?
How often did doctors communicate well with patients? Always Usually Sometimes/never	During this hospital stay… • how often did doctors treat you with courtesy and respect? • how often did doctors listen carefully to you? • how often did doctors explain things in a way you could understand?
How often did patients receive help quickly from hospital staff? Always Usually Sometimes/never	During this hospital stay… • after you pressed the call button, how often did you get help as soon as you wanted it? • how often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?
How often was patients' pain well controlled? Always Usually Sometimes/never	During this hospital stay… • how often was your pain well controlled? • how often did the hospital staff do everything they could to help you with your pain?
How often did staff explain about medicines before giving them to patients? Always Usually Sometimes/never	Before giving you any new medicine… • how often did hospital staff tell you what the medicine was for? • how often did hospital staff describe possible side effects in a way you could understand?
How often were patients' rooms and bathrooms kept clean? Always Usually Sometimes/never	During this hospital stay… • how often were your room and bathroom kept clean?
How often was the area around patients' rooms quiet at night? Always Usually Sometimes/never	During this hospital stay… • how often was the area around your room quiet at night?
Were patients given information about what to do during their recovery at home? Yes/No	During this hospital stay… • did hospital staff talk with you about whether you would have the help you needed when you left the hospital? • did you get information in writing about what symptoms or health problems to look out for after you left the hospital?
How do patients rate the hospital? High (9 or 10) Medium (7 or 8) Low (6 or below)	Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?
Would patients recommend the hospital to friends and family? Definitely recommend Probably recommend Probably/definitely would not recommend	Would you recommend this hospital to your friends and family?

higher volume of Medicaid patients had lower percentages of patients with a 9 or 10 overall rating. Jha et al. also found significant relationships between hospital quartile rankings on the overall 9 or 10 rating and composite scores on the Hospital Compare quality of care measures for acute myocardial infarction (AMI), heart failure, pneumonia, and surgical care improvement, after adjusting for the same hospital characteristics.

Wennberg et al. examined the associations between the HCAHPS overall rating, the hospital care intensity index (a measure of regional propensity to rely on the acute care hospital in managing chronic illness for Medicare beneficiaries in the last two years of life), and Hospital Compare process quality measures for AMI, heart failure and pneumonia.[11] They found that patients living in hospital referral regions[i] with greater inpatient care intensity tended to rate their inpatient care less favorably, and that hospitals in regions with lower HCAHPs overall ratings also tended to have lower scores on the process quality measures.

Kutney-Lee et al. examined the relationship between HCAHPS scores, the nurse work environment and nurse staffing in 430 hospitals in four states (California, Florida, New Jersey and Pennsylvania).[12] Most of the hospitals were large (91% were over 100 beds) and urban (92%). For these hospitals, the nurse work environment was significantly related to attaining the top category of responses on all HCAHPS measures, and nurse staffing was significantly related to attaining the top score on three measures (discharge information, overall rating, and recommendation for hospital).

The current study makes a new contribution in two ways. First, the study examines differences in HCAHPS scores across hospital type and geographic location: 1) between critical access hospitals (CAHs), rural Prospective Payment System (PPS), and urban PPS hospitals[ii] and 2) by rurality (hospitals located in metropolitan, micropolitan and non-core counties)[iii] while controlling for hospital organizational characteristics. Second, unlike earlier studies that only assessed differences between the top category of responses and the other categories combined, this study uses the additional information included in the three-level HCAHPS response categories by employing ordered logistic regression models and calculating effect sizes for each significant explanatory variable.

[i] Hospital Referral Regions are defined by the Dartmouth Atlas to reflect Medicare beneficiaries' referral patterns for major cardiovascular surgical procedures and neurosurgery.

[ii] A CAH is a small (25 beds or less) rural hospital with an annual average length of stay of less than 96 hours per acute care patient. It must be located at a distance from other hospitals or certified by the state as a necessary provider of health care services. CAHs receive cost-based Medicare reimbursement, which PPS hospitals are reimbursed under the Medicare DRG system.

[iii] The Office of Management and Budget defines metropolitan areas as central counties with one or more urbanized areas and outlying counties that are economically tied to the core counties as measured by work commuting. Nonmetropolitan counties are those outside the boundaries of metropolitan areas and are subdivided into two types: micropolitan areas, centered on urban clusters of 10,000 or more persons, and all remaining "noncore" counties. US Department of Agriculture. Economic Research Service. Measuring Rurality: What is Rural? http://www.ers.usda.gov/Briefing/Rurality/What|sRural/

RESEARCH HYPOTHESES

Hypotheses about relationships between patients' perspectives of hospital quality of care and key hospital characteristics

Based on the previous literature and our knowledge of rural hospital environments,[13-15] a number of hospital organizational factors were hypothesized to affect scores on HCAHPS measures, including hospital size and geographic location, teaching status, use of hospitalists, nurse staffing, and pharmacist staffing, hospital competition, and type of ownership (for-profit versus public or private not for profit).

A low volume of inpatient hospitalizations and a greater degree of rurality were hypothesized to be related to higher HCAHPS scores on measures involving communication with health care professionals and receiving help when needed. Patients in smaller and more rural hospitals tend to have pre-hospitalization interpersonal relationships with nurses and physicians, which can positively influence communication, while the small scale of the hospital allows health professionals to pay greater attention to individual patients' needs.

Teaching status was expected to negatively impact physician communication scores, because of the likelihood that patients would be receiving care from multiple physicians with whom they were unlikely to have a prior patient-physician relationship (e.g., medical residents). If hospitalists practice full time in the hospital setting and do not have an ongoing relationship with patients, their use also may negatively impact physician communication scores. However, to the extent that they are able to provide continuity of care during the inpatient hospital stay, their use may have a positive impact on communication.

Higher nurse staffing relative to patient volume and higher proportions of RNs were expected to positively influence scores on the nurse communication, receiving help as soon as needed, medication explanation, pain control, discharge information, overall rating and recommendation measures. Higher nursing assistant and total hospital personnel staffing relative to patient volume were expected to positively influence scores on the responsiveness of staff and cleanliness of patient room and bathroom measures. Higher pharmacist staffing relative to patient volume was expected to positively influence scores on the pain control and medication explanation measures.

A low volume of inpatient hospitalizations and a greater degree of rurality were expected to be inversely related to HCAHPS scores on the pain management and medication explanation measures because of more limited resources (e.g., fewer hospital pharmacists and specialized pain management programs) in smaller, rural hospitals. A low volume of inpatient hospitalizations and a greater degree of rurality also were expected to be related to higher HCAHPS scores on measures involving quiet and cleanliness of the hospital environment because smaller hospitals may tend to be less busy.

Based on the AHRQ HCAHPS results, patients in small hospitals and those in large hospitals were expected to be more likely to definitely recommend a hospital to family and friends than those in medium-sized hospitals. Relative to medium-sized hospitals, smaller hospitals may provide more personalized care, resulting in patients being more likely to recommend them; patients may also have fewer options nearby. A greater likelihood to recommend large hospitals may be related to the greater resources and wider range of specialty services offered.

Competition, as measured by the number of hospitals in the service area, was expected to positively influence the overall hospital rating and the hospital recommendation measures. Based on results found by Jha et al., for profit ownership was hypothesized to negatively impact scores on these two measures.[10]

Hypotheses about relationships between patients' perspectives of hospital quality of care and process of care quality measures

Three potential ways were hypothesized that a hospital's process of care scores might be related to its HCAHPS scores. First, to the extent that individual patients are aware of receiving the recommended services in the individual process of care measures and this information enters into their assessment of their hospital experience, higher scores on these process measures might lead directly to higher HCAHPS scores. For example, one of the heart failure process of care measures addresses whether the patient was given detailed discharge instructions, while one of the HCAHPS measures addresses whether the patient received information about what to do during recovery at home. Several process of care measures address whether AMI and heart failure patients have certain medications given upon arrival and prescribed at discharge, while an HCAHPS measure addresses staff explanations about medications.

Second, since the recommended services for the individual process of care measures have been shown in clinical studies to positively impact quality, better outcomes resulting from receipt of recommended care may have a direct, positive effect on patients' assessments of their experience of care as measured by HCAHPS scores.

Third, as an alternative to these two direct effects, the same factors that lead a hospital to have higher process of care scores might also impact satisfaction ratings or be related to other factors that impact satisfaction ratings. Under this interpretation, the process of care composite measures would have an indirect impact on HCAHPS scores through measured or unmeasured factors that influence both process of care quality and patient satisfaction.

DATA AND METHODS

The study uses hospital-level HCAHPS and Hospital Compare process measure data for the fourth quarter of 2006 and the first three quarters of 2007 (October 2006 through September 2007) downloaded from the CMS website in September 2008. These data are linked with data on hospital characteristics from the Fiscal Year 2007 American

Hospital Association (AHA) Annual Survey, and data on Critical Access Hospitals (CAHs) from a database maintained by the Flex Monitoring Team. A total of 2,558 hospitals were in the HCAHPS dataset. Of these, eight hospitals were missing data on all HCAHPS measures. Thirteen hospitals could not be matched to the AHA data.

A subset of hospitals from the AHA database, including general medical/surgical hospitals and specialty hospitals such as cardiac and orthopedic hospitals, were used to calculate HCAHPS participation rates and to compare participating and non-participating hospitals. Children's hospitals, long term care and psychiatric facilities were excluded. The denominators for the participation rates included hospitals with HCAHPS data that could not be matched to the AHA database and CAHs from the Flex Monitoring Team CAH database that also could not be matched to the AHA database.

In the first part of the analysis, we examine the relationships between rural patients' assessments of the quality of care they received while hospitalized and key hospital characteristics that may influence patients' experiences of hospital care, using regression models. The dependent variables in the models are the HCAHPS measures that address a key aspect of patients' hospital experiences (e.g., communication with doctors, communication with nurses, pain management, etc.), as well as the overall rating of the hospital, and the willingness to recommend rating. The independent variables in the models include hospital organizational characteristics such as the volume of inpatient hospitalizations and nurse staffing per patient day ratios, and hospital service area characteristics, such as the county degree of rurality and the extent of hospital competition.

Two sets of models are run for each measure. In the first set of models, hospitals are categorized according to reimbursement type and location as CAHs, rural PPS, and urban PPS hospitals. In the second set of models, all hospitals are assigned to one of three geographic categories: metropolitan, micropolitan or non-core, based on the county where the hospital was located. A separate set of models are calculated rather than including both sets of variables in the same models because of the high correlation between reimbursement type and rurality.

The second part of the analysis examines whether rural and urban patients' perspectives of hospital quality are related to hospital process of care quality measures, using HCAHPS scores for the two summary HCAHPS measures, the overall hospital rating and the patient recommendation of the hospital measure, and Hospital Compare process of care measures for AMI, heart failure, pneumonia. For these analyses ordered logistic regression models are estimated for the two summary HCAHPS measures that assess the impact of the condition-specific process of care composite scores for AMI, heart failure and pneumonia and a hospital-wide aggregate composite score. The independent variables in these models again include hospital organizational and service area characteristics.

Model Estimation and Specifications

To estimate the impact of covariates on the response variables in the HCAHPS data, ordered logistic regression models are used. The HCAHPS measures are ordinal variables with three categories of responses that can be ordered in a meaningful way (e.g., the “always” response is better than the “usually” response, which in turn is better than the “sometimes/never” response). (The exception is the dichotomous yes/no discharge information variable; a logistic regression model is used for this variable.)

The ordered logistic regression model takes into account the full informational content of the three level data response. It is preferred on conceptual and statistical grounds over a multinomial logistic regression model, which is appropriate for nominal data where no ordering is implied. It is also preferred over a binomial logistic model that is estimated by collapsing the two lower categories of responses into a single category that contrasts with the highest category of responses. For certain tests of hypotheses, we conducted sensitivity tests of the ordered logistic regression models by estimating multinomial logistic regression models, as noted.

The HCAHPS data that CMS makes available to researchers consists of the percentage of a hospital’s survey respondents that scored the hospital in each of the three categories of responses. CMS does not provide the exact number of completed survey responses for each hospital; it only indicates whether the number of responses was less than 100, 100 to 300, or over 300. To address this lack, an imputed value of the survey sample size for each hospital was calculated and used in conjunction with the number of responses at each satisfaction level to calculate hospital-and-satisfaction level frequency weights. (See Appendix A). The “cluster” robust variance estimation method in Stata was used to obtain appropriate standard errors that account for the clustering of respondents within hospitals and their possible correlation to any hospital-level unmeasured variables that affect all the responses from a given hospital.

The AHA data used includes measures of hospital size (inpatient days for the total facility, hospital unit and long term care unit, if any); staffing (FTE total personnel, RNs, LPNs, nursing assistants and pharmacists, and the use of hospitalists); teaching hospital status; Joint Commission and American Osteopathic Association accreditation status; ownership (grouped into public/non-federal government, private non-profit, and for-profit); and competition (number of hospitals in the health service area).

The AHA nursing personnel data include the number of registered nurse (RN), licensed practical nurse (LPN) and Nursing Assistant (NA) full-time-equivalents (FTEs) employed by the reporting facility. Since the HCAHPS data are collected from inpatients only, the ideal specification for modeling purposes would include only nursing personnel devoted to inpatient services. However, the AHA measures also include nursing personnel who provide outpatient care and care in any nursing homes attached to hospitals. To address these potential sources of measurement error and normalize the measures for modeling purposes, RN, LPN and NA FTEs were divided by adjusted patient days (the sum of actual inpatient days plus the equivalent number of inpatient days accounted for

by outpatient revenue). A control variable was also included, which was calculated by dividing hospital FTE total personnel by the sum of hospital plus nursing home FTE total personnel to account for the relative use of nursing personnel in the hospital and the nursing home parts of the facility. This 'facility nurse staffing control variable' is retained in the model specifications even when it is not significant.

A number of alternative model specifications were used to test the possible impact of nurse staffing on the nurse communication and receiving help quickly when needed measures. They included:

- the number of RN FTEs per adjusted patient day, the number of LPN FTEs per adjusted patient day, and the number of Nursing Assistant (NA) FTEs per adjusted patient day, entered individually into the model;
- the sum of RN FTEs and LPN FTEs per adjusted patient day, along with the RN proportion of the total nursing FTEs; and
- the sum of RN, LPN and NA FTEs, along with variables that measure the RN and the LPN proportion of the total nursing FTEs.

These specifications have been used extensively in the literature to assess the impact of nurse staffing levels on hospital and nursing home quality outcomes.[12-13] In addition to ordered logistic regression models, multinomial regression models were estimated as well for the nurse communication measure. Finally, the sample was restricted to hospitals with no associated nursing homes to test whether this source of measurement error in the adjusted patient day normalization might be influencing the results.

The raw coefficients of the variables in ordered logistic regression models are difficult to interpret due to the complexity of these non-linear models in assessing the probabilities of attaining each of the three levels of satisfaction. Therefore, for each explanatory variable, a measure of *effect size* is calculated that assesses the impact of moving from the 10th percentile to the 90th percentile of the distribution of that variable on the probability of attaining each of the three levels of satisfaction for each HCAHPs measure.[iv] For the dichotomous variables, the effect size is calculated for the impact of going from not having the characteristic to having it.

Statistical analyses were performed using Stata version 10 (Stata Corp, College Station, TX).

[iv]The effect size provides a measure of impact of continuously distributed explanatory variables that is grounded in the actual distribution of data. It avoids the often exaggerated measurement of difference associated with using the minimum and maximum values of each covariate by using a range of values in which 80% of the hospitals are empirically found. Another metric sometimes used for ease of interpretation of continuous covariates in nonlinear models is the marginal effect, which measures the impact for the probabilities of a one-unit increase in each covariate. For continuous variables, a marginal effect can involve a very small change and is not very informative when it does. It also doesn't provide any idea of the range of units over which it might be meaningful to assess the impact of a variable.

RESULTS

Participation in HCAHPS Public Reporting

For the last quarter of 2006 and the first three quarters of 2007, the time period of the data used in this analysis, PPS hospitals could suppress public reporting of their HCAHPS results; reporting was voluntary for CAHs, as it remains now. For this time period, a total of 2,258 hospitals, including 286 CAHs, 551 rural PPS hospitals and 1,721 urban PPS hospitals reported HCAHPS data (Table 1).[v]

Table 1
Public Reporting of HCAHPS Data Q4 2006/Q1-Q3 2007

	Number (%) Reporting HCAHPS Data
Type of Hospital	
Critical Access Hospitals	286 (22.2%)
Rural PPS Hospitals	551 (53.2%)
Urban PPS Hospitals	1721(63.4%)
Urban Influence Code	
1. Large metro (1+ million)	998 (62.3%)
2. Small metro (<1 million)	782 (58.7%)
3. Micropolitan adjacent to large metro	77 (55.4%)
4. Non-core adjacent to large metro	32 (27.1%)
5. Micropolitan adjacent to small metro	228 (55.9%)
6. Non-core adjacent to small metro, with town of 2,500 residents or more	133 (33.9%)
7. Non-core adjacent to small metro, with town of 2,500 residents or more	19 (16.5%)
8. Micropolitan not adjacent to metro	153 (46.8%)
9. Non-core adjacent to micro, with town of 2,500 residents or more	47 (22.7%)
10. Non-core adjacent to micro, no town of 2,500 residents or more	14 (12.2%)
11. Non-core not adjacent, with a town of 2,500 residents or more	65 (39.9%)
12. Non-core not adjacent, no town of 2,500 residents or more	10 (8.5%)

Hospitals located in metropolitan and micropolitan areas were more likely to publicly report HCAHPS data than hospitals located in non-core areas. Compared to non-reporting hospitals, hospitals that publicly reported during this time period were significantly larger as measured by inpatient days, admissions, births, surgeries, and FTE staffing (Table 2).

[v] A preliminary analysis of data for the last two quarters of 2007 and the first two quarters of 2008, when PPS hospitals could no longer suppress their results, indicated that the numbers of hospitals reporting had increased significantly; a total of 413 CAHs, 945 rural PPS hospitals and 2,353 urban PPS hospitals reported data for this time.

Table 2
Characteristics of Hospitals Publicly Reporting and Not Reporting HCAHPS Data for Q4 2006/Q1- Q3 2007

	Hospitals Reporting (N = 2558) Mean	Hospitals Not Reporting (N = 2478) Mean
Adjusted Patient Days	93,452	44,491
Inpatient Admissions	10,370	3,727
Births	1,248	398
Inpatient surgeries	3,056	1,067
FTE Total Personnel Hospital	1,243	567
FTE Registered Nurses Facility	347	145
FTE LPNs Facility	27.5	21.0

Relationship between HCAHPS Measures and Hospital Organizational Characteristics

The results of the models for CAHs, rural PPS and urban PPS hospitals and the models for urban, rural non-core and micropolitan hospitals were very similar. Therefore, the results for the urban, rural non-core and micropolitan hospitals are presented here, and the results for CAHs, rural PPS and urban PPS hospitals are included in Appendix B.

For each of the HCAHPS measures, the unadjusted mean HCAHPS scores and the mean scores adjusted for the covariates in the ordered logistic regression models are presented, followed by the effect sizes for the significant policy relevant variables in the model.

Communication with Physicians
Among the 2,076 hospitals with data on the use of hospitalists, non-core hospitals have a significantly higher unadjusted mean percentage of patients reporting that physicians always communicated well (83.9%) than micropolitan hospitals (81.3%); micropolitan hospitals in turn have a significantly higher unadjusted mean percentage than urban hospitals (77.9%) (Table 3).

The covariates in the ordered logistic regression model include non-core and micropolitan location, the number of inpatient days (in 100,000's) and its square, teaching hospital status, whether the hospital uses hospitalists, and for-profit status. Adjusting for these covariates reduces the mean percent in the "always" category by 1.4% for non-core hospitals and 0.8% for micropolitan hospitals, and increases it by 0.6% for urban hospitals. Differences between non-core, micropolitan and urban hospitals remain statistically significant.

Table 3
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Physician Communication

Physician communicated well with patient	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	83.9%	81.3%	77.9%
Usually	12.6%	14.5%	17.0%
Sometimes or Never	3.5%	4.2%	5.1%
Adjusted for covariates in regression model			
Always	82.5%	80.5%	78.5%
Usually	13.6%	15.1%	16.6%
Sometimes or Never	3.9%	4.4%	4.9%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
Inpatient days (in 100,000s)	-3.2%	2.3%	0.9%
Teaching hospital	0.8%	-0.6%	-0.2%
Use of hospitalists	-0.7%	0.5%	0.2%
For-profit status	-2.8%	2.0%	0.8%

All of the covariates in the model are statistically significant at p <.05. The number of inpatient days and for-profit status have the largest effect sizes and both are negative. Moving from the 10th to the 90th percentile of inpatient days reduces the likelihood of attaining the “always” category by 3.2%, while for-profit status (compared to non-profit and public status) reduces it by 2.8%. Teaching hospital status increases the likelihood of attaining the “always” category by 0.8%, while using hospitalists decreases it by 0.7%.

Since 19% of the hospitals were missing data on the hospitalist variable, the ordered logistic regression models were re-run on all the hospitals with HCAHPS data, including those missing data on the hospitalist variable, but omitting the hospitalist variable from the model. The results were very similar to the previous model.

Communication with Nurses

Non-core hospitals have a significantly higher unadjusted mean percentage of patients reporting that nurses always communicated well than micropolitan hospitals (78.5% vs. 75.5%) (Table 4). Micropolitan hospitals in turn have a significantly higher unadjusted mean percentage than urban hospitals (71.2%).

The covariates in the ordered logistic regression model include non-core and micropolitan location, the number of inpatient days (in 100,000s) and its square, RNs per adjusted patient day, for-profit status and the facility nurse staffing control variable. All variables except for the facility nurse staffing control variable are statistically significant (p<.01).

Table 4
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Nurse Communication

Nurse communicated well with patient	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	78.5%	75.5%	71.2%
Usually	16.9%	19.2%	22.2%
Sometimes or Never	4.6%	5.4%	6.6%
Adjusted for covariates in regression model			
Always	77.1%	74.5%	71.8%
Usually	17.9%	19.9%	21.8%
Sometimes or Never	4.9%	5.7%	6.5%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
Inpatient days (in100,000s)	-4.0%	2.8%	1.2%
RN FTEs per adjusted patient day	1.2%	-0.9%	-0.4%
For-profit status	-6.6%	4.6%	2.0%

Adjusting for these covariates reduces the mean percentage in the “always” category by 1.4% for non-core hospitals and by 1.0% for micropolitan hospitals, and increases urban hospitals by 0.6%. Differences between non-core, micropolitan and urban hospitals remain statistically significant. For-profit status and inpatient days have large negative effect sizes, while RN staffing has a smaller positive effect size. For-profit status (compared to non-profit and public status) results in a 6.6% reduction in the likelihood of attaining the “always” category, while moving from the 10th to the 90th percentile of inpatient days results in a 4.0% reduction. Moving from the 10th to the 90th percentile of RN staffing increases the likelihood of attaining the “always” category by 1.2%.

Responsiveness of Hospital Staff

The unadjusted mean percentage of patients reporting that they always received help when needed from hospital staff was highest in non-core hospitals (68.3%), followed by micropolitan (64.9%) and urban hospitals (57.7%) (Table 5).

The covariates in the ordered logistic regression model included non-core and micropolitan location, the number of inpatient days (in 100,000s) and its square, RNs per adjusted patient day, for-profit status and the facility nurse staffing control variable. Adjusting for these covariates reduces the mean percent in the “always” category by -2.5% for non-core and by -1.7% for micropolitan hospitals, and increases it by 1.0% for urban hospitals. Differences between non-core, micropolitan and urban hospitals remain statistically significant.

All variables in the model are statistically significant at $p < .001$ except for the facility nurse staffing control variable. Moving from the 10th to the 90th percentile of inpatient days reduces the likelihood of attaining the “always” category by -7.4%. For-profit status

reduces the likelihood by -7.2%, while increasing from the 10th to the 90th percentile of RNs per adjusted patient day increases the likelihood of attaining the “always” category by 1.8%.

Table 5
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Patient Received Help As Soon As Wanted

Patient Received Help As Soon As Wanted	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	68.3%	64.9%	57.7%
Usually	22.6%	24.7%	28.7%
Sometimes or Never	9.0%	10.4%	13.6%
Adjusted for covariates in regression model			
Always	65.8%	63.2%	58.7%
Usually	24.2%	25.7%	28.2%
Sometimes or Never	10.0%	11.1%	13.1%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
RN FTEs per adjusted patient day	1.8%	-1.0%	-0.8%
Inpatient days (in 100,000s)	-7.4%	4.0%	3.4%
For-profit status	-7.2%	3.7%	3.5%

Pain Management

The unadjusted mean percentage of patients reporting that their pain was always well-controlled was highest in non-core hospitals (71.6%), followed by micropolitan (69.3%) and urban (66.2%) (Table 6).

The ordered logistic regression model included non-core and micropolitan location, the number of inpatient days (in 100,000s) and its square, RNs per adjusted patient day, and for-profit status. Adjusting for these covariates reduces the mean percentage in the “always” category by -1.1% for non-core and by -0.8% for micropolitan hospitals while it increases it by 0.4% for urban hospitals. All variables in the model except for the facility nurse staffing control variable are statistically significant ($p<.01$). Differences between non-core, micropolitan and urban hospitals remain statistically significant.

For-profit status (compared to non-profit and public status) results in a -4.5% reduction in the likelihood of attaining the “always” category. Moving from the 10th to the 90th percentile of inpatient days reduces the likelihood of attaining the “always” category by -3.4%; moving from the 10th to the 90th percentile of RNs per adjusted patient day increases the likelihood by 1.4%.

Table 6
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Pain Management

Pain was controlled well	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	71.6%	69.3%	66.2%
Usually	21.9%	23.5%	25.6%
Sometimes or Never	6.5%	7.2%	8.2%
Adjusted for covariates in regression model[1]			
Always	70.5%	68.5%	66.6%
Usually	22.6%	24.0%	25.3%
Sometimes or Never	6.9%	7.5%	8.1%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
RN FTEs per adjusted patient day	1.4%	-0.9%	-0.5%
Inpatient days (in 100,000s)	-3.4%	2.3%	1.1%
For-profit status	-4.5%	2.9%	1.5%
Separate model when RN FTEs per adjusted patient day are not included			
Pharmacist FTEs per adjusted patient day/1000	1.0%	-0.7%	-0.3%

We hypothesized that pharmacist FTEs per adjusted patient day also would have an impact on patients' assessments of whether their pain was well controlled. The RN FTE per adjusted patient day and pharmacist FTE per adjusted patient day variables were highly correlated (r = .69), and neither was significant when both were included in the model. In a separate model, which included pharmacists but did not include RNs, the pharmacist FTE variable was significant and had an effect size of 1.0%, which was similar to the 1.4% effect size for the RN FTE variable.

Medication Explanations

The unadjusted mean percentage of patients reporting that staff always explained about medications before giving them is highest in non-core hospitals (63.7%), followed by micropolitan hospitals (60.3%) and urban hospitals (55.9%) (Table 7).

Adjusting for the covariates of the ordered logistic regression model, which included non-core and micropolitan location, the number of inpatient days (in 100,000s) and its square, pharmacists per adjusted patient day, and for-profit status, reduces the mean percentage in the "always" category by -1.4% for non-core hospitals and by -1.0% for micropolitan hospitals, while urban hospitals increased by 0.5%.

Table 7
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Medication Explanations

Staff explained medications before giving to patient	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	63.7%	60.3%	55.9%
Usually	17.0%	18.1%	19.2%
Sometimes or Never	19.3%	21.7%	24.9%
Adjusted for covariates in regression model			
Always	62.3%	59.3%	56.4%
Usually	17.5%	18.3%	19.1%
Sometimes or Never	20.2%	22.3%	24.5%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
Inpatient days (in 100,000s)	-3.8%	1.0%	2.8%
Pharmacist FTEs per patient day/1000	1.4%	-0.4%	-1.0%
For-profit status	-5.7%	1.4%	4.3%

For-profit status reduces the likelihood of attaining the “always” category by -5.7%. Moving from the 10th to the 90th percentile of inpatient days reduces the likelihood of attaining the “always” category by -3.8%; moving from the 10th to the 90th percentile of pharmacists per adjusted patient day increases the likelihood by 1.4%.

As noted above, the RN FTEs per patient day and pharmacist FTEs per patient day variables were highly correlated, so the two staffing variables were not included in the same model. A separate model was estimated that included the RN staffing variable, but not the pharmacist variable. The fit of this alternative model was not as good. RN staffing was significant ($p<.01$), and it also had an effect size of 1.4% in the likelihood of attaining the “always” category.

Quiet around Patient’s Room at Night

The unadjusted mean percentage of patients reporting that the area around their room was always quiet at night is highest in non-core hospitals (61.1%), followed by micropolitan hospitals (56.5%) and urban hospitals (51.5%) (Table 8).

The covariates in the ordered logistic regression model included non-core and micropolitan location, the number of inpatient days (in 100,000s) and its square, and for-profit status. All variables except for-profit status were statistically significant. Adjusting for the covariates reduces the mean percentage in the “always” category by -2.3% for non-core hospitals and by -1.5% for micropolitan hospitals, while urban hospitals increased by 0.8%. Differences between non-core, micropolitan and urban hospitals remain statistically significant. Moving from the 10th to the 90th percentile of inpatient days reduces the likelihood of attaining the “always” category by -6.3%.

Table 8
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Area around Patient's Room Kept Quiet at Night

Area around patient's room kept quiet at night	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	61.1%	56.5%	51.5%
Usually	28.0%	30.7%	33.2%
Sometimes or Never	10.9%	12.8%	15.3%
Adjusted for covariates in regression model			
Always	58.8%	55.0%	52.3%
Usually	29.4%	31.4%	32.8%
Sometimes or Never	11.8%	13.5%	14.9%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
Inpatient days (in 100,000s)	-6.3%	3.1%	3.1%

Cleanliness of Patient Room and Bathroom

The unadjusted mean percentage of patients reporting that their room and bathroom were always clean is highest in non-core hospitals (75.5%), followed by micropolitan hospitals (71.9%) and urban hospitals (65.6%) (Table 9).

In the ordered logistic regression model, all of the covariates are statistically significant at p<.001. Adjusting for the number of inpatient days (in 100,000s) and its square, total FTE personnel per adjusted patient day and for-profit status reduces the mean percentage in the "always" category by -2.5% for non-core hospitals and -1.8% for micropolitan hospitals, while urban hospitals increased by 1.1%. Differences between non-core, micropolitan and urban hospitals remain statistically significant.

Moving from the 10th to the 90th percentile of inpatient days reduces the likelihood of attaining the "always" category by -7.1%. For-profit status reduces the likelihood by -5.8%, and moving from the 10th to the 90th percentile of total hospital personnel FTEs per adjusted patient day increases the likelihood by 1.1%.

Table 9
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Patient Room and Bathroom Clean

Patient Room and Bathroom Clean	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Always	75.5%	71.9%	65.6%
Usually	16.9%	19.1%	22.7%
Sometimes or Never	7.6%	9.0%	11.7%
Adjusted for covariates in regression model			
Always	73.0%	70.1%	66.7%
Usually	18.5%	20.1%	22.1%
Sometimes or Never	8.6%	9.7%	11.2%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
Inpatient days (in 100,000s)	-7.1%	4.0%	3.2%
Total hospital personnel FTEs per adjusted patient day	1.1%	-0.6%	-0.5%
For-profit status	-5.8%	3.1%	2.6%

Discharge Information

The unadjusted mean percentage of patients reporting that they received information about what to do during their recovery at home was highest in non-core hospitals, (81.5%) followed by micropolitan hospitals (80.7%) and urban hospitals (78.7%) (Table 10).

The ordered logistic regression model included the number of inpatient days (in 100,000's) and its square, total RNs and LPNs per adjusted patient day, RN percent of the total nursing FTEs, for-profit status and the hospital staff as a proportion of hospital and nursing home staff control variable. Adjusting for these covariates decreased the "yes" percent for micropolitan and for non-core hospitals by -0.3% and increased the urban "yes" percent by 0.1%.

All variables are statistically significant except the facility nurse staffing control variable. For-profit status decreases the likelihood of attaining the "always" category by -3.1%. A move from the 10th to the 90th percentile of inpatient days decreases the likelihood by 1.8%. RN and LPN FTEs per adjusted patient day and the RN percent of total nursing FTEs have positive effect sizes of 0.6% and 0.9% respectively.

Table 10
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Staff Gave Patient Discharge Information

Staff gave patient discharge information	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Yes	81.5%	80.7%	78.7%
No	18.5%	19.3%	21.3%
Adjusted for covariates in regression model			
Yes	81.2%	80.4%	78.8%
No	18.8%	19.6%	21.2%
Effect Size for Significant Variables in Regression Model			
Variable	**Yes**		
Inpatient days (in 100,000s)	-1.8%		
Total RN and LPN FTEs per adjusted patient day	0.6%		
RN percent of total nursing staff FTEs	0.9%		
For-profit status	-3.1%		

Overall Rating of Hospital

Table 11 shows the unadjusted mean scores for patients' overall rating of the hospital. Similar to other measures, non-core hospitals had the highest percent (67.4%) of hospitals with a score of 9 or 10, followed by micropolitan hospitals (64.1%) and urban hospitals (62.2%).

The covariates of the ordered logistic regression model include the number of inpatient days (in 100,000s) and its square, hospitals in the service area (number and squared); total nursing personnel FTEs (RNs, LPNs, NAs) per adjusted patient day; percent of nurses that are RNs; accreditation by the Joint Commission and/or the American Osteopathic Association; for profit status; and the facility nurse staffing control variable.

Adjusting for these covariates reduces the mean percentage in the "9 or 10" category by -1.2 % for non-core and 0.3% for micropolitan hospitals and increases it by 0.3% for urban hospitals.

All covariates except for the staffing control variable are statistically significant. Three covariates have a negative effect on the likelihood of attaining a high (9 or 10) overall rating: for-profit ownership (-7.0%); inpatient days (-4.4%); and accreditation (-3.1%). Four covariates have a positive effect on the likelihood of attaining a high overall rating: number of hospitals in the service area (2.4%); total nursing personnel FTEs per adjusted patient day (2.4%); and RNs as a percent of total nursing FTEs (2.5%).

Table 11
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Overall Rating of Hospital

Overall Rating of Hospital (1-10 scale)	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
High (9 or 10)	67.4%	64.1%	62.2%
Medium (7 or 8)	23.5%	25.5%	26.5%
Low (6 or below)	9.2%	10.5%	11.2%
Adjusted for covariates in regression model			
High (9 or 10)	66.2%	63.8%	62.5%
Medium (7 or 8)	24.2%	25.6%	26.3%
Low (6 or below)	9.6%	10.6%	11.1%
Effect Size for Significant Variables in Regression Model			
Variable	**High (9 or 10)**	**Medium (7 or 8)**	**Low (6 or below)**
Number of hospitals in the service area	2.4%	-1.4%	-1.0%
Inpatient days (in 100,000s)	-4.4%	2.5%	1.8%
Total nursing FTEs (RNs, LPNs, nursing assistants) per adjusted patient day	2.5%	-1.5%	-1.0%
RN percent of total nursing staff FTEs	2.0%	-1.2%	-0.8%
Accreditation	-3.1%	1.9%	1.3%
For-profit ownership	-7.0%	3.9%	3.1%

Patient Recommendation of Hospital

Table 12 shows the unadjusted mean scores for the patient recommendation of hospital measure. Non-core hospitals have the highest percent (70.0%) of hospitals with a "definitely recommend" score, followed by urban hospitals (67.3%) and micropolitan hospitals (66.6%). Micropolitan hospitals are not significantly different from urban, while non-core hospitals are significantly different from both micropolitan and urban.

After adjusting for size (small or medium volume of inpatient days compared to high volume), total nursing FTEs per adjusted patient day, RN percent of nursing FTEs, and ownership status, neither non-core or micropolitan hospitals are significantly different from urban hospitals or each other. (Small volume was set at the 30th percentile inpatient days; large at the 70th percentile; and medium included the middle 40th percentile.)

Compared to public or private non-profit hospitals, for-profit status reduces the likelihood of being in the "definitely recommend" category by -6.8%. A small volume of inpatient days (compared to medium or large volume), increases the likelihood of being in the "definitely recommend" category by 3.5% and a move from the 10th percentile to the 90th percentile of the RN percent of nurse FTEs increases it by 2.5%.

Table 12
Mean HCAHPS Scores for Non-Core, Micropolitan, and Urban Hospitals: Patient Recommendation of Hospital

Recommendation of Hospital	Rural		Urban (N = 1780)
	Non-core (N = 320)	Micropolitan (N = 458)	
Unadjusted			
Definitely recommend	70.0%	66.6%	67.3%
Probably recommend	24.5%	27.1%	26.5%
Probably or definitely would not recommend	5.5%	6.3%	6.1%
Adjusted for covariates in regression model			
Definitely recommend	68.8%	66.7%	67.6%
Probably recommend	25.5%	27.0%	26.4%
Probably or definitely would not recommend	5.8%	6.3%	6.1%
Effect Size for Significant Variables in Regression Model			
Variable	**Always**	**Usually**	**Sometimes or never**
Small volume of inpatient days (30th percentile value)	4.4%	-3.2%	-1.1%
Total nursing FTEs (RNs, LPNs, nursing assistants) per adjusted patient day	3.5%	-2.6%	-0.9%
RN percent of total nursing staff FTEs	2.5%	-1.9%	-0.7%
For-profit ownership	-6.8%	4.9%	1.9%

Relationship between Process of Care Scores and HCAHPS Scores

The second part of the analysis examines the relationship between the Hospital Compare AMI, heart failure and pneumonia inpatient process of care measures and patients' assessments of care as measured by HCAHPS scores. For this analysis, hospital condition-specific composite scores are created for AMI, heart failure and pneumonia by summing the numerators (i.e., the number of patients receiving recommended care) and the denominators (i.e., the number of patients who are eligible to receive that care) for the process of care measures by condition. The three condition-specific composite scores are then summed to create an aggregate process of care composite score, referred to as the hospital-wide composite score.

The three potential ways that a hospital's process of care scores might be related to its HCAHPS scores discussed in the Research Hypotheses section are tested by empirically assessing whether AMI, pneumonia and heart failure composite scores are associated with significantly higher HCAHPS scores. The case for such an influence would likely be strongest for the two summary HCAHPS measures: 1) overall hospital rating and 2) patient recommendation of the hospital. Therefore, four ordered logistic regression models are estimated for the two summary HCAHPS measures, the overall hospital rating and the patient recommendation of the hospital measure. A full set of covariates are included in the models, with one model for each HCAHPS measure including each of the three condition-specific composite scores and the hospital-wide aggregate composite score. Effect sizes are calculated for each of the composite measures.

While AMI, pneumonia and heart failure are among the most common reasons for adult inpatient hospitalizations, each condition affects a relatively small proportion of the total inpatients in a hospital. Thus, one would not expect to see very large impacts due to the first two hypothesized ways that composite scores could impact HCAHPS summary scores. The first two hypotheses posit that higher quality directly impacts, and only impacts, individual patients with the condition. On the other hand, a hospital-wide aggregate composite score would likely have a larger direct effect than any of the individual composite scores.

Table 13 shows the increase in the probability of achieving the highest score (9-10) on the overall rating of the hospital measure, and Table 14 shows the increase in the probability of achieving a "definitely recommend" score for the patient recommendation of hospital measure. The three condition-specific and the hospital-wide aggregate composite scores have a limited range of values, as illustrated by the 10th and 90th percentile values in these tables (given in the 2nd and 3rd columns from the left in the tables).

For both models, the effect sizes for pneumonia and heart failure are positive and statistically significant ($p < .01$). The impacts are smaller and not significant for AMI in both models. The impact of the hospital-wide composite score is substantially larger than the individual effects and very significant ($p < .00001$).

Table 13
Relationship between Pneumonia, Heart Failure, AMI and Aggregate Composite Scores and HCAHPS Overall Rating of Hospital

Effect Size for Composite Scores				
	Range of Values		Statistical Significance in Regression Model	Increase in Probability of Scoring High (9-10) on Overall Hospital Rating
	10th Percentile	90th Percentile		
Pneumonia composite score	82.5%	96.4%	<.01	1.9%
Heart failure composite score	70.0%	96.5%	<.01	1.6%
AMI composite score	82.7%	99.1%	NS	0.4%
Hospital composite score (aggregate of all three conditions)	81.5%	96.2%	<.001	3.2%

Table 14
Relationship between Pneumonia, Heart Failure, AMI and Aggregate Composite Scores and HCAHPS Patient Recommendation of Hospital

Effect Size for Composite Scores				
	Range of Values		Statistical Significance in Regression Model	Increase in Probability of Scoring "Definitely Recommend"
	10th Percentile	90th Percentile		
Pneumonia composite score	82.5%	96.4%	<.01	1.7%
Heart Failure composite score	70.0%	96.5%	<.01	1.5%
AMI composite score	82.7%	99.1%	NS	0.6%
Hospital composite score (aggregate of all three conditions)	81.5%	96.2%	<.001	3.2%

SUMMARY AND CONCLUSIONS

Relationships between patients' perspectives of hospital quality of care and key hospital characteristics

Hospitals in rural areas have significantly higher ratings on HCAHPS measures than those located in urban areas. Within rural areas, hospitals in less densely populated rural areas (non-core) have significantly higher scores than those in more densely populated (micropolitan) areas. After controlling for hospital organizational factors, including hospital size and staffing, these differences by rurality remain significant, although somewhat diminished quantitatively, for all of the HCAHPS measures except the patient recommendation of hospital measure.

Among the hospital organizational factors, for-profit status and hospital inpatient volume tend to have the largest effects on HCAHPS scores. For-profit status has a significant negative effect on all HCAHPS measures except one (whether the patient room's was quiet at night). Hospital inpatient volume has a significant negative effect on all HCAHPS measures. The negative relationship between for-profit ownership and the HCAHPS measures is consistent with Jha et. al,[9] who found a negative relationship between for profit status and the overall hospital rating. However, the size of the effect is surprisingly large relative to other hospital organizational characteristics.

Nursing and pharmacist staffing variables have smaller, but significant positive effects on several measures. The registered nurse FTE per adjusted patient day variable has a significant positive impact on the nurse communication, receiving help as soon as needed, pain control, and medication explanation measures. The total nursing FTE (including RNs, LPNs and Nursing Assistants) per adjusted patient day variable and the RN percentage of nursing FTEs variable have significant positive impacts on the discharge information, overall rating and recommendation measures. In alternative models for the pain control and medication explanation measures that do not include

RN staffing (because of the high correlation between RN and pharmacist staffing), the pharmacist FTEs per adjusted patient day variable has significant positive effects.

Other organizational characteristic variables have a small impact on some HCAHPS measures. Teaching hospital status has a small positive impact on the physician communication measure while using hospitalists has a small but significant negative impact. The number of hospitals in the service area has a small positive impact on the overall rating and recommendation measures.

Relationships between patients' perspectives of hospital quality of care and process of care quality measures

The heart failure and pneumonia process of care composite measures have a statistically significant impact on the HCAHPs overall rating and recommendation scores; the AMI composite measure does not. For both the overall hospital rating and the hospital recommendation models, the effect sizes for the pneumonia and heart failure composite scores are reasonably strong, considering that these individual conditions represent small subsets of inpatients.

The aggregate process of care composite score, which combines the AMI, heart failure and pneumonia process of care composite scores, has a larger and more significant impact on HCAHPS scores than the individual composite measures. However, its effect size (3.9% and 3.8% respectively for the overall rating and recommendation models) is still smaller than the effect sizes for some of the organizational characteristic variables in the previous models (e.g., size and for-profit ownership).

The overall better performance of smaller, rural hospitals on the HCAHPS measures contrasts with their generally lower overall performance on the process of care measures, especially the AMI and heart failure measures, relative to larger urban hospitals.[18-21] These differences in performance suggest that the process of care measures and the HCAHPS measures are measuring different aspects of quality.

FUTURE RESEARCH

Future research should examine changes in the number of hospitals reporting HCAHPS data, particularly CAHs, which are currently publicly reporting on a voluntary basis without the financial incentive PPS hospitals have for reporting. Given the differences in characteristics of reporting and non-reporting hospitals, it will be important to analyze whether HCAHPS scores change over time and how those changes are related to hospital characteristics. It will also be important to identify which hospitals are successfully improving their HCAHPS scores and how they are doing it, so that other hospitals may learn from them.

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Appendix A: Calculation of an Imputed Value of the Survey Sample Size

CMS does not provide the exact number of completed responses for each hospital's HCAHPS data, but gives the range of completed surveys for each hospital for the following categories: < 100, 100-300, >300. To weight our analysis to reflect the differing sample sizes for hospitals, we needed to quantify the variability in survey sample size across hospitals. Our approach to the lack of exact survey size values was to assume, alternatively, one of two sets of boundary assumptions (Table A-1) and assess empirically whether these two assumptions made any significant difference for our target explanatory variables' coefficients. (These are sample surveys and as such are not related to size of institution per se; the upper value of either 300 or 450 does not grossly under-estimate the survey sizes of the largest hospitals since larger hospitals would have much smaller sampling fractions than the smallest hospitals.)

Table A-1
Values Assumed Under High And Low Boundary Assumptions

CMS Range	High boundary assumption	Low boundary assumption
< 100	100	50
100 - 300	200	200
> 300	450	300

A useful way to assess the importance of the different assumptions concerning the weights is with a simple specification that uses only the Urban PPS, Rural PPS and CAH classification variables. Table A-2 below shows the changes in mean percentage-points of respondents who rate a hospital as high, medium, or low, by these three hospital types induced by changing our assumption concerning the mean sample size in the ranges provided by CMS. Going from the low boundary to the high boundary assumption of completed surveys yields only very minor changes in the allocation of high, medium and low for all three categories of hospitals.

Table A-2
Impact of Change from Low Boundary to High Boundary Assumption of Survey Sample Size

	Urban PPS	Rural PPS	CAH
Low	-0.03%	-0.04%	0.06%
Medium	-0.01%	-0.03%	0.13%
High	0.04%	0.07%	-0.19%

For example, reading down the column for CAHs, by using the high boundary assumption instead of the low boundary assumption, the mean percentage who rate their hospital low increases by 0.06%-points, the mean percentage who rate their hospital medium also increases by 0.13%-points, and finally the mean percentage who rate their hospital high decreases by 0.19%-points. These are very small changes, and they are the largest that were found for all three types of hospital locations/types. Stated

differently, differences in the percentage of a hospital's respondents reporting High, Medium and Low (for which CMS provided exact data) dominate the effects of any likely differences in size of the completed sample, at least given the distribution of hospitals across these three ranges. (For the sample of hospitals used in our analyses, 87% of the hospitals were in the > 300 category, with 11.5% in the middle and 1.5% in the lowest.)

We used the imputed values of the overall survey sample size for each hospital—in conjunction with the percentages of a hospital's total patient survey respondents that scored the hospital in the High, Medium or Low categories—to impute the number of respondents giving each of the three satisfaction levels. This imputed number of respondents in each level was used as the frequency weight for that hospital-and-satisfaction level for use in the STATA statistical software. Finally, we used the "cluster" robust variance estimation method within STATA to obtain appropriate standard errors that account for the clustering of these respondents within hospitals and hence their possible correlation through any hospital-level unmeasured variables that affect all the responses from a given hospital.

Appendix B. Results of Models for CAHs, Rural PPS and Urban PPS Hospitals

Table B-1
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Physician Communication

Physician communicated well with patient	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	83.3%	81.9%	77.7%
Usually	13.0%	14.1%	17.1%
Sometimes or Never	3.7%	4.0%	5.2%
Adjusted for covariates in regression model			
Always	81.7%	81.1%	78.4%
Usually	14.2%	14.7%	16.7%
Sometimes or Never	4.1%	4.2%	5.0%

Table B-2
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Nurse Communication

Nurse communicated well with patient	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	79.0%	75.8%	71.0%
Usually	16.5%	18.9%	22.3%
Sometimes or Never	4.4%	5.3%	6.7%
Adjusted for covariates in regression model			
Always	77.3%	75.1%	71.5%
Usually	17.8%	19.4%	21.9%
Sometimes or Never	4.9%	5.5%	6.5%

Table B-3
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Patient Received Help As Soon As Wanted

Patient Received Help As Soon As Wanted	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	71.3%	64.6%	57.3%
Usually	20.7%	24.9%	28.9%
Sometimes or Never	7.9%	10.5%	13.8%
Adjusted for covariates in regression model			
Always	68.6%	63.2%	58.2%
Usually	22.5%	25.7%	28.4%
Sometimes or Never	8.9%	11.1%	13.3%

Table B-4
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Pain Management

Pain was controlled well	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	71.3%	69.7%	66.1%
Usually	22.1%	23.2%	25.7%
Sometimes or Never	6.6%	7.1%	8.3%
Adjusted for covariates in regression model			
Always	69.8%	69.1%	66.5%
Usually	23.1%	23.6%	25.4%
Sometimes or Never	7.1%	7.3%	8.1%

Table B-5
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Medication Explanations

Staff explained medications before giving to patient	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	63.9%	60.7%	55.7%
Usually	17.0%	17.9%	19.3%
Sometimes or Never	19.1%	21.3%	25.0%
Adjusted for covariates in regression model[1]			
Always	62.1%	60.0%	56.2%
Usually	17.5%	18.1%	19.2%
Sometimes or Never	20.4%	21.8%	24.6%

Table B-6
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Area around Patient's Room Kept Quiet at Night

Area around patient's room kept quiet at night	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	60.3%	57.5%	51.3%
Usually	28.5%	30.1%	33.3%
Sometimes or Never	11.2%	12.4%	15.4%
Adjusted for covariates in regression model[1]			
Always	57.9%	56.1%	52.1%
Usually	29.9%	30.9%	32.9%
Sometimes or Never	12.2%	13.1%	14.9%

Table B-7
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Patient Room and Bathroom Clean

Patient Room and Bathroom Clean	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Always	78.1%	71.7%	65.3%
Usually	15.3%	19.2%	22.9%
Sometimes or Never	6.6%	9.1%	11.9%
Adjusted for covariates in regression model[1]			
Always	75.5%	70.3%	66.3%
Usually	16.9%	20.0%	22.3%
Sometimes or Never	7.6%	9.7%	11.4%

Table B-8
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Staff gave patient discharge information

Staff gave patient discharge information	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Yes	81.4%	80.9%	78.6%
No	18.6%	19.1%	21.4%
Adjusted for covariates in regression model[1]			
Yes	80.8%	80.8%	78.7%
No	19.2%	19.2%	21.3%

Table B-9
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Overall Rating of Hospital

Overall Rating of Hospital (1-10 scale)	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
High (9 or 10)	68.8%	64.3%	62.0%
Medium (7 or 8)	22.6%	25.3%	26.7%
Low (6 or below)	8.6%	10.4%	11.3%
Adjusted for covariates in regression model[1]			
High (9 or 10)	67.1%	64.4%	62.2%
Medium (7 or 8)	23.6%	25.2%	26.5%
Low (6 or below)	9.3%	10.3%	11.2%

Table B-10
Mean HCAHPS Scores for Critical Access, Rural PPS and Urban PPS Hospitals: Patient Recommendation of Hospital

Recommendation of Hospital	Critical Access Hospitals (N = 286)	Rural PPS Hospitals (N = 551)	Urban PPS Hospitals (N = 1721)
Unadjusted			
Definitely recommend	71.3%	66.9%	67.2%
Probably recommend	23.5%	26.9%	26.6%
Probably or definitely would not recommend	5.1%	6.2%	6.2%
Adjusted for covariates in regression model			
Definitely recommend	69.1%	67.1%	67.5%
Probably recommend	25.3%	26.7%	26.4%
Probably or definitely would not recommend	5.7%	6.2%	6.1%