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The Evolving Science of Quality Measurement for Hospitals: Implications for Studies of Competition and Consolidation

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The literature on hospital competition and quality is young; most empirical studies have focused on few conditions and outcomes. Measures of in-hospital mortality and complications are susceptible to bias from unmeasured severity and transfer/discharge practices. Only one research team has evaluated related process and outcome measures, and none has exploited chart-review or patient survey-based data. Prior studies have generated inconsistent findings, suggesting the need for additional research. We describe the strengths and limitations of various approaches to quality measurement, summarize how quality has been operationalized in studies of hospital competition, outline three mechanisms by which competition may affect hospital quality, and propose measures appropriate for testing each mechanism.

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To evaluate the effects of competition and consolidation in health care markets on quality of care, it is essential to understand the capabilities and limitations of the tools currently available for measuring quality. The number and scope of these tools have grown considerably over the past two decades, as a result of aggressive efforts by Federal and state agencies, accrediting organizations, and employer coalitions. These developments have created new opportunities to understand how competition and consolidation affect quality of care, although critics may still challenge the validity of any particular quality measure. The fundamental problem, as we discuss below, is that quality of care has multiple dimensions, and organizations that perform well on one dimension may not perform well on others. It is all too easy to arrive at the wrong conclusion if one focuses on a single measure, or even on multiple measures of a single dimension.

In this paper, we first set forth a standard definition of health care quality and an associated typology of quality problems. We describe the three general approaches to quality measurement, focusing on their strengths and limitations for studies of the impact of hospital competition and consolidation. Next we summarize how these measures have been applied in previous studies, and how the authors of those studies have dealt with concerns about confounding and endogeneity. We argue that future studies of provider competition and quality should apply multiple measures of multiple dimensions of quality, focusing on measures that are most likely to respond to changes in competition. We conclude by describing a conceptual framework that may be helpful in identifying promising measures for future studies in this area.

1. Definitions of Quality and Quality Problems

In this paper, we adopt a clinical perspective on quality of care. Avedis Donabedian (1980), one of the founders of the modern science of health care quality measurement, defined the quality of medical care as "the management that is expected to achieve the best balance of health benefits and risks ... (taking) into account the patient's wishes, expectations, valuations, and means ... (and) the social distribution of that benefit within the population." The American Medical Association (1984) defined high-quality care more narrowly as care that "consistently contributes to the improvement or maintenance of the quality and/or duration of life." Perhaps the most authoritative definition was published by the Institute of Medicine (1990), which defined quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."

All of these definitions attempt to distinguish between quality and other non-price aspects of service, which we might classify as "amenities." Amenities include aspects of appearance, comfort, and convenience, such as the number of television channels available to hospital patients, the number of menu choices, and the quality of decoration. In making this distinction, we acknowledge that the line between amenities and quality may become blurred, especially with important patient-centered measures such as telephone response time, wait time for appointments, clinic hours, prompt complaint resolution and claims payment, and patient satisfaction. Nonetheless, this distinction is useful because it focuses attention on whether provider organizations expend resources in ways that are likely to improve patient outcomes, or in ways that are designed to give the appearance of quality.

In this paper, we also follow the Institute of Medicine's (1999) typology of quality problems (Chassin et al., 1998) as involving inappropriate overuse (i.e., too much care), inappropriate underuse (i.e., too little care), and misuse. Although this conceptualization may conflict with Pauly's (2003) definition of quality as "everything about some good or service relevant to consumers' well-being that is not measured by quantity," we prefer to place all provider judgments and recommendations regarding appropriate care in the category of "quality" rather than "quantity." For example, underuse of coronary revascularization among African-American patients probably reflects inappropriate substitution of medical therapy for invasive therapy (Kressin and Petersen, 2001; Ford and Cooper, 1995), not constrained

supply or insufficient consumer demand. As Donabedian (1980) noted, "assessments of the quantity and of the quality of care are thus inextricably intertwined . . . "

2. Approaches to Quality Measurement

Donabedian (2003) has described the three broad approaches to quality measurement as structure, process, and outcomes. This useful schema has been widely adopted by the health services research and quality improvement communities. Structural measures describe the conditions under which care is provided, and encompass material resources such as facilities and equipment, human resources such as the credentials and experience of health care providers, and organizational characteristics such as patient volume and team nursing. Process measures describe the content of health care, and encompass health care providers' activities in the realms of screening, diagnosis, pharmacotherapy, surgery, rehabilitation, patient education, and prevention. Finally, outcome measures describe changes attributable to health care, and encompass mortality, morbidity, functional status and pain, as well as patients' health-related knowledge, behaviors, and satisfaction. Although this schema remains conceptually useful, it is sometimes difficult to apply. For example, the shared features of "high-reliability organizations" (Reason, 2000) include both the structural conditions under which professionals work and how that work is performed.

2.1. Structural Measures of Quality

Structural measures may be viewed as enabling or facilitating factors that make it easier or harder for health professionals to provide high-quality care. Although such structural measures as teaching status (Ayanian and Weissman, 2002), rural location (Keeler et al., 1992), and hospital ownership (Thomas, Orav and Brennan, 2000) are easy to measure, and have been repeatedly associated with processes and outcomes of care, these associations tend to be weak. Structural measures typically explain little of the observed variability in processes and outcomes (Mitchell and Shortell, 1997). Some providers are able to offer effective care despite structural problems, whereas others offer relatively ineffective care despite structural advantages.

Another problem with structural features is that they are often hard to modify, with a few notable exceptions such as personnel qualifications and low-cost equipment. Because of the cost and infeasibility of many structural interventions, and the difficulty of blinding patients and providers, relatively few randomized controlled trials of structural interventions have been published (Ioannidis and Lau, 2001). As a result, the direction of the causal pathway between structural and process measures is often unclear. Do better structures lead to better processes and outcomes of care, or do better processes and outcomes generate demand for different structures? For example, there is empirical evidence that higher hospital volume leads to better outcomes ("practice makes perfect") (Halm, Lee, and Chassin, 2002), but there is also evidence that better outcomes lead to higher volume ("selective referral") (Luft, Hunt, and Maerki, 1987), and even evidence of no association in selected settings (Khuri et al., 1999). The same problem of reverse causation may affect other modifiable structural measures, including hospital medical staff characteristics.

The practical problem with applying structural measures to evaluate the impact of hospital competition and consolidation is that pro-competitive and anti-competitive interventions may directly affect structural measures. When hospital mergers result in integration or elimination of clinical services, these effects become tautologic. For example, a merger in which one hospital purchases a financially troubled neighbor, and converts it to an ambulatory surgery center, inherently increases the volume of inpatient services at the purchasing facility. A merger between a teaching hospital and a community hospital may involve conversion of the latter to a teaching facility. Although volume and teaching status are often *associated with quality* of care, they should not be viewed as true *measures of quality,* but rather as mediating variables that lie along the causal pathway by which hospital mergers improve or compromise quality of care. Showing that competition and consolidation affect these structural measures does not prove that they actually affect quality of care.

2.2. Process Measures of Quality

Process measures offer several advantages for quality improvement and health policy. They are directly actionable by health care providers, offering "opportunities for intervention," because they reflect how providers evaluate and treat patients. Some process measures have been tested in randomized controlled trials, so we are reasonably certain that they improve patient outcomes when correctly applied. However, others are based on weaker evidence such as observational studies or professional consensus. Most importantly, process measures elucidate the mysterious pathways by which market forces affect patient outcomes. This feature is particularly attractive if changes in market structure are unavoidable, because clinical and policy interventions could be implemented to block the pathway that would otherwise lead to poorer outcomes. For example, if hospital consolidation seems likely to increase emergency transport times for acutely ill patients, then it would be important to monitor and reduce wait times in emergency department(s) to ensure that patients still receive antibiotic therapy for pneumonia, and thrombolytic therapy for myocardial ischemia, in a timely manner. Such process measures can also function as an "early warning system" to identify adverse effects of market changes before the resulting differences in patient outcomes become measurable.

Despite these attractive features, there are several practical problems with using process measures to study the effects of competition and consolidation. First, process measures are typically more costly to collect than either structural or outcome measures, because they usually require reviewing medical records, observing or interviewing providers, and/or surveying patients about their experiences. Of course, the increasing adoption of electronic medical record systems promises to reduce the future cost of process measurement. Linked laboratory and physician claims can facilitate process measurement for Medicare beneficiaries and others with chronic diseases, such as diabetes and coronary artery disease (Lawthers et al., 1995; Weiner et al., 1995). Linked pharmacy claims for Medicaid beneficiaries have been used cost-effectively to measure medication-related processes of care (McManus et al., 2000).

Process measures fall into two broad categories: explicit measures, which focus on specific, verifiable actions by health care providers (e.g., prescribing beta blockers to patients

after myocardial infarction, monitoring glycosylated hemoglobin levels among diabetics), and implicit measures, which represent global assessments of quality by experienced providers. Explicit measures are typically collected by surveying patients about specific aspects of care (e.g., whether they were educated about their medications at hospital discharge), by training nurses to review medical records, or by searching claims data for appropriate screening or diagnostic tests or indicated therapies. Recent innovations in explicit process measurement include standardized patients (i.e., trained actors) and detailed clinical vignettes (i.e., simulated cases) (Peabody et al., 2000). Implicit measures require semi-structured review of medical records by professionals with clinical expertise similar to that of the targeted professional, who evaluate the adequacy of care and whether better care could have improved outcomes (Brook, McGlynn, and Cleary, 1996).

Explicit and implicit measures have complementary weaknesses, in that explicit measures often lack evidence supporting their predictive validity despite convincing face validity (Wei et al., 1995), whereas implicit measures tend to suffer from poor reliability (Ashton et al., 1999), bias due to harsh or lenient reviewers (Hayward, McMahon and Bernard, 1993), and bias due to the reviewer's professional training (Smith et al., 1997). Some explicit measures have been adopted by consensus among clinical experts in one setting, but have been rejected elsewhere because of differing professional norms and interpretations of the evidence (Rhew, Goetz and Shekelle, 2001; Marshall et al., 2003). Explicit measures that focus on the completeness of physicians' history-taking, physical diagnosis, patient education, or treatment recommendations may be less reliably ascertained through medical record review (Luck et al., 2000) than measures that focus on the use of laboratory tests, medications, or procedures (Marciniak et al., 1998).

Multiple independent reviews may optimize the reliability of implicit review (Goldman, 1992), although discussion among reviewers may force consensus without improving reliability (Hofer et al., 2000). Other disadvantages of implicit measures are that they are not as actionable as explicit measures, they underestimate the true frequency of quality problems (Weingart et al., 2002), and they may be biased when reviewers know which patients suffered adverse outcomes (Caplan, Posner and Cheney, 1991). On the other hand, implicit measures are more broadly applicable across clinical conditions than evidence-based explicit measures—an important advantage for evaluating small hospitals that have relatively few patients in any single condition or procedure category.

2.3. Outcome Measures of Quality

Outcome measures represent the "bottom line" that really matters to patients, their families, and their communities. They differ from structural and process measures in that they are inherently meaningful and generally easy for non-clinicians to understand. Outcomes also reflect not just what was done, but also how well it was done. For example, the technical skills of a surgeon may not be apparent from chart review, but may be exposed by monitoring the outcomes of his or her patients. Finally, the major advantage of outcome measures for studies of hospital competition and quality is that they can often be ascertained using administrative data sets, such as those distributed through the Agency for Healthcare Research and Quality's (AHRQ's) Healthcare Cost and Utilization Project (HCUP). Death is well reported in most

data sets, and can be validated using the National Death Index or the Medicare Beneficiary file. Longitudinally linked data sets with encrypted identification numbers can be used to ascertain readmissions, although there is some disagreement about whether readmission is actually a clinically meaningful and valid outcome (Ashton et al., 1997; Benbassat and Taragin, 2000).

Of course, outcome measures also suffer from several problems that may interfere with their use to identify the effects of competition and consolidation. Most importantly, severity of illness varies widely across providers, and may even vary within providers over time. Severity of illness may therefore confound either before-, after-, or inter-market comparisons of patient outcomes (Iezzoni, 1997; Green et al., 1990), especially when competition or consolidation influence patient selection. For example, competition for coronary bypass graft procedures in states that disseminate risk-adjusted mortality data apparently led to improved patient matching, with more clustering of high-risk patients at teaching hospitals, but may have stimulated supplier-induced demand for revascularization among low-risk patients who are less likely to benefit (Dranove et al., 2003). Severity of illness would not be such a problem but for the fact that it is poorly captured using administrative data (Pine et al., 1997).

Three recent developments promise to increase the utility of administrative data for risk-adjusting patient outcomes. First, crude measures of comorbidity based on the Charlson Index and APACHE (Acute Physiology and Chronic Health Evaluation) system have given way to more sophisticated measures that use a wider panoply of comorbid diagnoses (Elixhauser et al., 1998; Stukenborg, Wagner and Connors, 2001; Johnston et al., 2002). There is increasing recognition that comorbidity weights vary across outcome measures and clinical settings (Romano, Roos and Jollis, 1993; Ghali et al., 1996; van Doorn et al., 2001), making it important to customize risk-adjustment models instead of applying coefficients estimated in prior studies. Second, internal data linkages in many data sets now allow researchers to use prior hospitalizations (Zhang, Iwashyna and Christakis, 1999), outpatient claims (Klabunde et al., 2000), and pharmacy utilization data (Schneeweiss et al., 2001) to enhance ascertainment of chronic comorbidities. Third, the sensitivity with which major comorbidities are reported appears to have improved (Fisher et al., 1992; Kashner, 1998; Quan, Parsons and Ghali, 2002), although recent comprehensive data are not available. Finally, some health data agencies have improved their reporting systems, most notably by adding diagnosis fields to avert "truncation bias" (Romano and Mark, 1994) and by attaching a "sixth digit" to each International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code indicating whether the diagnosis was present at admission or developed subsequently (Roos et al., 1997).

Another important limitation of outcome measures for identifying the effects of hospital competition and consolidation is that the selected outcomes may not be under providers' control to a meaningful extent, and may be so delayed or rare as to compromise statistical power. Before undertaking analyses based on outcome measures, researchers should estimate their power, based on realistic estimates of both the baseline outcome rate and the anticipated effect size. Analyses of the temporal pattern of adverse outcomes may be helpful to quantify the maximum achievable effect (Seagrott and Goldacre, 1994). If the proposed analysis promises to have insufficient power, a larger data set, more frequent (composite)

or more highly preventable outcome (Hofer and Hayward, 1996), or a longer ascertainment period may be necessary.

Other potential sources of bias in studies of the effects of competition and consolidation on quality result from variation across hospitals and markets in inter-hospital transfer rates and lengths of stay. Changes in hospital markets, whether pro-competitive or anti-competitive, may induce changes in transfer practices and mean length of stay, which may obscure effects on patient outcomes (Jencks, Williams and Kay, 1988; Kaboli et al., 2001). For example, the pro-competitive Cleveland Health Quality Choice program, which was intended to promote informed decision-making by consumers and purchasers, substantially decreased inpatient mortality (its primary outcome variable) without reducing 30-day mortality (Baker et al., 2003). The obvious solution to this problem is to link sequential hospitalizations, specify time-delimited outcomes such as 30-day mortality, and attribute those outcomes back to the originating hospital (or perhaps apportion outcomes across all of the hospitals involved in the patient's care).

Finally, the range of outcome measures that can be validly ascertained using administrative data is somewhat limited. Although several research groups have promoted ICD-9-CM based complication measures (Iezzoni et al., 1994), we and others have demonstrated that most of the component codes suffer from inadequate overall sensitivity and variable sensitivity across hospitals (Romano et al., 2002; Geraci et al., 1997; Best et al., 2002). The predictive value of these complication codes appears to be higher for surgical patients than for medical patients (Lawthers et al., 2000). When a major postoperative complication is reported, there is generally at least a 60% probability that it occurred, but at least half of these complications go unreported because of poor documentation, coding errors, or restrictive coding rules.

3. Integrating Outcome and Process Measures of Quality

As we have discussed, both outcome and process measures have distinct advantages and disadvantages for assessing the effects of competition and consolidation in health care markets. Given that quality of care is a complex and multidimensional concept, no single measure of either process or outcome is likely to provide an adequate summary of the effects of competition and consolidation. Hospitals that perform well on risk-adjusted outcomes for one condition often perform poorly for unrelated conditions (Rosenthal, 1997; Chassin et al., 1989), making it useful to consider a spectrum of conditions. Similarly, explicit process measures must be developed and implemented on a condition-specific basis (Ashton et al., 1994).

It may be particularly useful to consider outcome and process measures together, as an integrated approach would offer a more complete assessment of quality and elucidate the pathways by which market forces affect patient outcomes. Observed agreement between process and outcome measures at the provider level would support the construct validity of each measure. Disagreement would suggest: (1) information bias attributable to misclassification on either measure; (2) confounding of outcome measures due to unmeasured severity of illness; (3) selection bias due to selective enrollment or dropout of high-risk patients; or (4) an incorrect conceptual model, based on an assumed process-outcome linkage that

does not actually exist (e.g., NCQA is dropping a menopausal counseling measure in light of evidence from the Womens' Health Initiative that the risks of postmenopausal hormone replacement typically outweigh the benefits). In practice, process and outcome measures are sometimes correlated, but often are not (Thomas and Hofer, 1998).

Over the past decade, several of the key organizations involved in quality measurement in the US, including the National Committee for Quality Assurance (NCQA), the Joint Commission for the Accreditation of Health Care Organizations (JCAHO), the National Forum for Health Care Quality Measurement and Reporting (NQF), and the Centers for Medicare and Medicaid Services (CMS) have worked toward consensus about an expanding set of inpatient quality measures. Provider-oriented organizations such as NCQA and JCAHO have historically focused on process measures, which tend to be clearly evidence-based and actionable, whereas consumer and employer-oriented organizations such as business coalitions, state health agencies, and the Leapfrog Group have focused on outcome and structural measures. However, the NQF and AHRQ's recent National Healthcare Quality Report[1] have helped bring together the best measures from both perspectives. Table 1 summarizes the recent convergence of opinion regarding suitable process and outcome indicators.

4. Operationalizing Quality in Hospital Competition Studies

Let us now consider how quality has been operationalized in previous studies of hospital competition and quality. To answer this question, we used several search engines (e.g., Medline, EconLit, etc.) to search the English-language literature for studies on the effects of hospital market structure on quality in the United States. Because this is an emerging field, we ensured comprehensiveness by comparing our results with several recent reviews of the literature and by querying researchers in the field. Our principal aim was to identify the specific quality measures and related methods used in prior studies, to help us appreciate the strengths and limitations of this literature. Through this process, we hope to offer recommendations for future research and guidance for policy analysts who need to assess the consequences of hospital mergers.

4.1. Using Outcomes to Measure Quality

Table 2 lists the measures used in 12 studies of the effects of hospital competition on quality of care. All of these papers report at least one outcome measure. The most commonly used outcome measure is mortality, which was used in every study. Readmission is the second most common outcome measure, and was used in three studies. Two papers report hybrid measures capturing a broad array of patient outcomes: Sari (2002) used a subset of the Healthcare Cost and Utilization Project (HCUP) Quality Indicators (QIs), and Wong and Mutter (2003) used the Patient Safety Indicators (PSIs), a subset of the AHRQ QIs, which replaced the HCUP QIs. Both of these measure sets include a mixture of mortality and morbidity (complication) measures based on ICD-9-CM, although the former set also includes nine measures of "potentially inappropriate utilization of hospital

Table 1. Structural, process, and outcome indicators endorsed by various entities involved in hospital quality measurement.

Indicator	JCAHO core measure	CMS QIOs	NQF	AHRQ QIs	Leapfrog group
Acute myocardial infarction					
Smoking cessation advice/counseling (≥18 yrs)	x	x	x		
Aspirin at arrival (within 24 hrs)	x	x	x		
Aspirin at discharge	x	x	x		
Beta-blocker at arrival (within 24 hrs)	x	x	x		
Beta-blocker at discharge	x	x	x		
Thrombolytic agent within 30 mins	x‡	x	x		
Percutaneous intervention within 120 mins	x‡	x	x		x
ACE-inhibitor at discharge for low LVF†	x	x	x		
In-hospital mortality (risk-adjusted)*	x		x	x	
Congestive heart failure					
Smoking cessation advice/counseling (≥18 yrs)	x	x	x		
Discharge instructions (activity/diet/weight/medications/follow-up)	x	x	x		
Assessment of LVF†	x	x	x		
ACE-inhibitor at discharge for low LVF†	x	x	x		
In-hospital mortality (risk-adjusted)*				x	
Community-acquired pneumonia					
Smoking cessation advice/counseling (≥18 yrs)	x	x	x		
Assessment of oxygenation at admission	x	x	x		
Blood cultures before antibiotics	x	x	x		
Antibiotic started within 4 hrs of arrival	x‡	x	x		
Appropriate initial antibiotic choice	x§	x	x		
Pneumococcal screen or vaccination (≥65 yrs)	x	x	x		
Influenza screen or vaccination (≥50 yrs)	**x**	x	x		
In-hospital mortality (risk-adjusted)*				x	
Surgical procedures and complications					
Antibiotic prophylaxis within 1 hr preop	x§	x	x		
Antibiotic discontinued within 24 hr postop	x§	x	x		
Appropriate antibiotic choice	x§	x	x		
Surgical methods and processes					
Incidental appendectomy (≥65 yrs)				x	
CABG surgery using internal mammary artery†			x		x
Laparoscopic vs. open cholecystectomy				x	

(*Continued on next page.*)

Table 1. (*Continued*).

Indicator	JCAHO core measure	CMS QIOs	NQF	AHRQ QIs	Leapfrog group
Pregnancy and related conditions					
3rd or 4th degree perineal laceration (risk-adjusted)*	x		x	x¶	
In-hospital neonatal mortality (risk-adjusted)*	x		x		
Cesarean delivery (low-risk women)			x	x	
Vaginal birth after cesarean delivery (risk-adjusted)	x		x	x	
Birth trauma*				x	
Hospital volume					
Abdominal aortic aneurysm repair**				x	x
Carotid endarterectomy**				x	
Coronary artery bypass graft surgery**			x	x	x
Esophageal resection (cancer)**				x	x
Pancreatic resection (cancer)**				x	x
Pediatric heart surgery**				x	
Percutaneous coronary interventions**			x	x	x
High-risk delivery (EBW < 1500 g, GA < 32 wks, known major anomaly)**†					x
ICU staffing by intensivist physicians**†					x
In-hospital mortality after other conditions (risk-adjusted)					
Gastrointestinal hemorrhage*				x	
Hip fracture*				x	
Acute stroke*				x	
Asthma treatment					
Use of relievers for inpatient asthma (<18 yrs)			x		
Use of systemic steroid for inpatient asthma (<18 yrs)			x		
Neonatal immunization after 60 hospital days			x		
Bilateral cardiac catheterization				x	
In-hospital mortality after other procedures (risk-adjusted)					
Abdominal aortic aneurysm repair*				x	
Pediatric heart surgery repair*				x	
Coronary artery bypass graft surgery*			x	x	x
Craniotomy*				x	
Esophageal resection (cancer)*				x	
Pancreatic resection (cancer)*				x	
Total hip arthroplasty*				x	
Percutaneous coronary interventions*			x		

(*Continued on next page.*)

Table 1. (*Continued*).

Indicator	JCAHO core measure	CMS QIOs	NQF	AHRQ QIs	Leapfrog group
Patient safety					
Urinary catheter-associated UTI: ICU*†			x		
Central line-associated blood infection: ICU*†			x		
Ventilator-associated pneumonia: ICU, high-risk nursery*†			x		
Falls reported*			x	x (postop hip fx)	
Computerized physician order entry**					x
Postoperative thromboembolism*				x	
Postoperative respiratory failure*				x	
Postoperative sepsis*				x	
Postoperative physiologic/metabolic derangement*				x	
Postoperative abdominopelvic wound dehiscence*				x	
Postoperative hemorrhage or hematoma*				x	
Iatrogenic pneumothorax*				x	
Accidental puncture or laceration*				x	
Foreign body left in*				x	
Decubitus ulcer*				x	
Selected infections due to medical care*				x	
Complications of anesthesia*				x	
Death in low-mortality DRGs*†				x	
Failure to rescue*				x	
Transfusion reaction*				x	

*Outcome measures.

†Abbreviations: LVF: left ventricular function; ACE: angiotensin converting enzyme; EBW: estimated birth weight; GA: gestational age; ICU: intensive care unit; CABG: coronary artery bypass graft; UTI: urinary tract infection; DRG: Diagnosis-Related Group.

‡ Time from arrival to initiation of indicated therapy is an alternative specification for these measures. For antibiotic timing in pneumonia, JCAHO also offers receipt of antibiotic within 8 hours of arrival as an alternative specification.

§Appropriate antibiotic choice for pneumonia is stratified by ICU versus non-ICU. Antibiotic-related measures for surgical prophylaxis are stratified by CABG, cardiac surgery, hip arthroplasty, knee arthroplasty, colon surgery, hysterectomy, and vascular surgery.

¶Includes 4th degree lacerations along with cervical, high vaginal, and internal injuries, with separate measures for spontaneous vaginal deliveries, instrumented vaginal deliveries, and cesarean deliveries.

**Structural measures.

Table 2. Measures used in studies of hospital competition and quality.

Author(s)	Approach	Condition/Procedure	Measure
Kessler and Geppert, 2003	Outcome	AMI	1-year mortality
			1-year readmission rate for AMI
			1-year readmission rate for CHF
Volpp et al., 2003	Process	Cardiac catheterization	Procedure rate
		Mechanical revascularization	Procedure rate
	Outcome	AMI	In-hospital mortality
Wong and Mutter, 2003	Outcome	AHRQ PSIs[1] (considered individually)	Hybrid
Gowrisankaran and Town, 2003	Outcome	Pneumonia	10-day in-hospital mortality
		AMI	30-day mortality
Mukamel, Zwanziger and Bamezai, 2002	Outcome	All causes	30-day mortality
		AMI	30-day mortality
		CHF	30-day mortality
		Pneumonia	30-day mortality
		Stroke	30-day mortality
Sari, 2002	Outcome	Subset of HCUP QIs[2] (7 categories)	Hybrid
Sohn et al., 2002a	Outcome	Newborns admitted to neonatal intensive care units within 24 hours of birth	In-hospital mortality
Sohn et al., 2002b	Outcome	PTCA	In-hospital mortality
Mukamel, Zwanziger and Tomaszeski, 2001	Outcome	All causes	30-day mortality
		AMI	30-day mortality
		CHF	30-day mortality
		Pneumonia	30-day mortality
		Stroke	30-day mortality
		CABG	30-day mortality
		Hip replacement surgery	30-day mortality
Ho and Hamilton, 2000	Process	Normal newborn	Discharge within 48 hours
	Outcome	AMI	In-hospital mortality
			90-day readmission
		Stroke	In-hospital mortality

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Table 2. (*Continued*).

Author(s)	Approach	Condition/Procedure	Measure
Kessler and McClellan, 2000	Outcome	AMI	1-year mortality
			1-year readmission rate for AMI
			1-year readmission rate for CHF
Shortell and Hughes, 1988	Outcome	16 measures[3] (considered as a group)	In-hospital mortality

Notes: AHRQ: Agency for Healthcare Research and Quality, AMI: acute myocardial infarction, CABG: coronary artery bypass grafting, CHF: congestive heart failure, HCUP: Healthcare Cost and Utilization Project, PSI: Patient Safety Indicators, PTCA: percutaneous transluminal coronary angioplasty, QI: Quality Indicator.
1. The tested PSIs included: (1) complications of anesthesia, (2) death in low mortality Diagnosis Related Groups (DRGs), (3) decubitus ulcer, (4) failure to rescue, (5) foreign body left in during procedure, (6) iatrogenic pneumothorax, (7) infection due to medical care, (8) postoperative hemorrhage or hematoma, (9) postoperative hip fracture, (10) postoperative physiologic and metabolic derangements, (11) postoperative respiratory failure, (12) postoperative pulmonary embolism or deep venous thrombosis, (13) postoperative sepsis, (14) postoperative wound dehiscence, (15) technical difficulty with procedure, (16) transfusion reaction, (17) birth trauma—injury to neonate, (18) obstetric trauma—Cesarean section (C-section), (19) obstetric trauma—vaginal with instrument, (20) obstetric trauma—vaginal without instrument.
2. *Inpatient mortality rates*: (1) hysterectomy, (2) laminectomy/spinal fusion, (3) cholecystectomy, (4) transurethral prostatectomy, (5) hip replacement, (6) knee replacement; *Complication rates*: (7) pulmonary compromise after major surgery, (8) AMI after major surgery, (9) gastrointestinal hemorrhage or ulceration after major surgery, (10) venous thrombosis or pulmonary embolism after major surgery/invasive vascular procedure, (11) mechanical complications due to device, implant, or graft (excluding organ transplant), (12) urinary tract infection after major surgery, (13) pneumonia after major surgery/invasive vascular procedure, (14) obstetrical complications, (15) adverse events and iatrogenic complications, (16) wound infection; *Potentially inappropriate utilization of hospital procedures*: (17) C-section delivery rate, (18) successful vaginal birth after C-section, (19) incidental appendectomy among elderly, (20) hysterectomy, (21) laminectomy and/or spinal fusion, (22) transurethral prostatectomy, (23) radical prostatectomy, (24) laparoscopic cholecystectomy, (25) CABG.
3. *Conditions*: (1) AMI, (2) acute tubular necrosis, (3) CHF, (4) cholecystitis and cholangitis, without mention of calculus, (5) pulmonary embolism; *Procedures*: (6) primary lens procedure, (7) cholecystectomy, (8) transurethral resection of prostate, (9) repair of inguinal hernia, (10) mastectomy, (11) excision or destruction of local lesion of bladder, (12) CABG, (13) laminectomy, (14) total hip replacement, (15) total knee replacement; *Complications*: (16) preventable complications and other misadventures in medical care and other complications (ICD-9 codes 995.2–995.4, 997.0, 998.0–998.6, 998.9, 990.0).

procedures" (most of which were dropped when the HCUP QIs were updated to the AHRQ QIs).

The time horizon for ascertaining mortality and other outcomes was limited to the acute hospitalization in seven studies, 30 days in three studies, and one year in two studies. Kessler and Geppert (2003) and Kessler and McClellan (2000) chose a one-year time frame to avoid the false inferences that can result from regional differences in mean length of stay. Using a one-year time frame addresses this concern, but it allows post-discharge care (for which hospitals are not responsible) to affect quality measures. Ho and Hamilton (2000) considered systematic differences in length of stay as an example of censoring. Using

Cox proportional hazards estimation, they modeled live patient discharge as a censored observation.

4.2. Using Process and Outcomes Together to Measure Quality

Two of the studies in Table 2 report process measures in addition to outcome measures. Volpp et al. (2003) studied procedure rates for cardiac catheterization and mechanical revascularization. They found that the adverse effects of a market reform (i.e., introducing hospital price competition and reducing subsidies for hospital care of the uninsured) on in-hospital mortality among uninsured patients after acute myocardial infarction (AMI) were partly explained by these process measures. Ho and Hamilton (2000) studied the impacts of mergers among hospitals, acquisitions of independent hospitals by systems, and acquisitions of system hospitals by another system. They found that the first two of these three specific types of hospital consolidation were associated with readmission, but neither was associated with inpatient mortality. The third type of consolidation was associated with their process measure of early newborn discharge.

4.3. Focusing on Acute Myocardial Infarction

Acute myocardial infarction is the most frequently analyzed condition in the hospital competition and quality literature. The author of two of these studies argues that since one-sixth of total hospital expenditures are devoted to the treatment of heart disease, analyses of how competition affects process and outcome measures for heart disease may generalize to other acute illnesses (Kessler and McClellan, 2000). A stronger argument for focusing on AMI is that it may circumvent problems associated with unobservable (to the investigator) differences in patient severity. Selection bias can result when patients or providers have the opportunity to choose the institution where treatment is received. Because patients with AMI require immediate care, typically at the closest hospital with an open emergency department, there is little opportunity for strategic hospital selection (Volpp et al., 2003; Gowrisankaran and Town, 2003). However, the same factors may make hospitals relatively uninterested in improving AMI care in response to competition, because successful hospitals would see little, if any, increase in patient volume for such a high-acuity, fixed-incidence condition. Although hospitals may be more responsive to competition for elective procedures, the infrastructure used to treat AMI patients is also used to deliver these higher-margin services. Thus, AMI mortality may serve as a reasonable, unbiased proxy for overall hospital quality.

Nonetheless, investigators should be careful in drawing conclusions from analyses of process and outcome measures related to one condition. Mukamel, Zwanziger, and Bamezai (2002) emphasize the importance of studying multiple conditions, as hospitals have different areas of expertise and their competency in treating one condition may reveal little about their competency in treating another (Rosenthal, 1997). Indeed, they found some heterogeneity in the estimated effect of competition on risk-adjusted excess mortality across four common conditions, adjusting for clinical expenditures per discharge.

4.4. Adjusting for Risk

The importance of risk adjusting when comparing measures of hospital quality is well documented (Iezzoni, 1997). In the context of this literature, failing to adjust for risk may give rise to omitted variable bias (i.e., confounding) and result in incorrect inferences about the effects of hospital competition on quality.

Table 3 lists the risk adjustment strategies that were employed in the 12 studies, and categorizes them by whether they feature adjustment to the dependent (quality) variable, use of independent covariates, or both. Dependent variable adjustment is seen in three papers. Wong and Mutter (2003) used the risk-adjusted rates produced by the AHRQ PSI software, which may be downloaded free at http://www.qualityindicators.ahrq.gov. These rates, which are adjusted for patient demographics (i.e., age, gender, age-gender interactions) and health status (i.e., collapsed DRG/co-morbidity category), reflect the quality of care that would be provided at each hospital if it had an "average" case mix. Gowrisankaran and Town's (2003) risk-adjusted 10-day in-hospital mortality rates for pneumonia adjust for both observable and unobservable differences in health status using a Bayesian model (Geweke, Gowrisankaran, and Town, 2003). Their risk-adjusted 30-day AMI mortality rates came from a logistic model developed by Luft and Romano (1997). Mukamel, Zwanziger and Bamezai (2002) used risk-adjusted mortality rates provided by the Health Care Financing Administration. These rates, which were adjusted for patient demographics (i.e., age and gender) and health status (i.e., principal diagnosis and comorbidities, source and type of admission, and risk score based on hospitalizations in the previous six months), have not been released to the public since 1993.

Of the nine remaining papers, in which independent covariates were used to adjust for severity of illness, five included risk-adjustment only at the patient level and three included risk-adjustment only at the hospital level. Shortell and Hughes (1988) adjusted for case severity at both levels. Sohn et al. (2002b) used 3M's All Patient Refined-Diagnosis Related Groups (APR-DRGs), a proprietary system evaluated by Iezzoni (1997) and Romano and Chan (2000), to adjust for health status at the patient level. Six papers adjusted for demographic factors at the patient level, and one paper adjusted for demographic factors at the hospital level. Six papers included some adjustment for socioeconomic variables.

4.5. Endogeneity Concerns

The papers listed in Table 2 represent initial attempts to examine the effects of hospital competition on quality. As such, it is not surprising that researchers are now recognizing some of their limitations. One issue that has come to the forefront is endogeneity. Kessler and McClellan (2000) showed that measures of hospital competition based on actual flows of patients may be endogenous. For example, high-cost hospitals may draw patients from larger areas (because of their higher quality) than low-cost hospitals, and thus appear more competitive within their market areas. To avoid this problem, they developed a measure of hospital competition based on exogenous determinants of patient flows, such as demographic characteristics and zip code of residence. Gowrisankaran and Town

Table 3. Risk adjustment strategies and primary data sets used in studies of hospital competition and quality.

Author(s)	Dependent-variable strategy	Independent-variable strategy	Primary dataset(s)
Kessler and Geppert, 2003	Not used	Health status (Patient level): • Hospitalization in year prior to AMI Demographic (Patient level): • Age • Gender • Race Socioeconomic (ZIP code level): • Fixed effects	Elderly FFS Medicare recipients hospitalized for a new AMI, 1985–1996
Volpp et al., 2003	Not used	Health status (Patient level): • AMI location • Previous CABG • CHF • Complications of diabetes • Cancer—high-risk or secondary malignancy • Chronic renal failure • Nutritional disorders • Previous pacemaker Demographic (Patient level): • Age • Gender	NJ and NY state discharge data AHRQ NIS, 1990–1996
Wong and Mutter, 2003	AHRQ PSI risk-adjusted rates	Socioeconomic (County level): • Per capita income • Unemployment rate • College graduation rate • Percentage African-American	AHRQ SID for AZ, CA, FL, IL, MA, MD, PA, and NY, 1997 and 2001
Gowrisankaran and Town, 2003	Risk-adjusted mortality rates from Geweke, Gowrisankaran, and Town (2003) and Luft and Romano (1997)	Not used	CA state discharge data, focusing on Los Angeles County, 1989–1993
Mukamel, Zwanziger and Bamezai, 2002	Risk-adjusted mortality rates from HCFA's Medicare Hospital Information Report	Health status (Hospital level): • All payer, DRG-based case mix index	Medicare Hospital Information Report, 1982 and 1989 (CA only)

(*Continued on next page.*)

Table 3. (*Continued*).

Author(s)	Dependent-variable strategy	Independent-variable strategy	Primary dataset(s)
Sari, 2002	Not used	Health status (Hospital level): • Mean number of secondary diagnoses • HCFA case mix index Demographic (Hospital level): • Mean age • Percentage infants • Percentage elderly • Percentage female Socioeconomic (Hospital level): • Mean patient income	AHRQ's NIS including AZ, CA, CO, FL, IA, IL, MA, NJ, PA, WA, and WI (1992–1997), plus CT, MD, NY, and OR (1993–1997), and MO (1995–1997)
Sohn et al., 2002a	Not used	Health status (Patient level): • Birth weight • Congenital anomalies	CA state discharge data, low birthweight neonates admitted to NICUs within 24 hours of birth, 1996–1998
Sohn et al., 2002b	Not used	Health status (Patient level): • 3M's APR-DRGs • Emergency room admission Demographic (Patient level): • Age • Gender • Race	CA state discharge data, PTCA recipients at 116 hospitals, 1995
Mukamel, Zwanziger and Tomaszeski, 2001	Not used	Health status (Hospital level): • Predicted mortality rates from HCFA's Medicare Hospital Information Report • Percentage of Medicaid days • Percentage of ICU days • Ratio of ER visits to total inpatient days Socioeconomic (ZIP Code level): • College graduation rate	Medicare Hospital Information Report, 1990 (1,927 hospitals in 134 MSAs)
Ho and Hamilton, 2000	Not used	Health status (Patient level) • Number of comorbidities • Cesarean delivery • Acute care hospital transfer (AMI) Demographic (Patient level) • Age • Gender • Race	CA state discharge data, 1991–1996

(*Continued on next page.*)

Table 3. (*Continued*).

Author(s)	Dependent-variable strategy	Independent-variable strategy	Primary dataset(s)
Kessler and McClellan, 2000	Not used	Demographic (Patient level): • Age • Gender • Race Socioeconomic (ZIP code level): • Fixed effects	Elderly, nonrural FFS Medicare recipients hospitalized for a new AMI, 1985–1994
Shortell and Hughes, 1988	Not used	Health status (Patient level): • Presence of combordities • Length of stay Health status (Hospital level): • Expected mortality • HCFA case mix index • Percentage of ICU days Demographic (Patient level): • Age • Sex Socioeconomic (County level): • Median income • Median years of education (≥25 years)	Medicare Part A claims, 1983–1984

(2003) adopted their methodology. Another example of potential endogeneity is Shortell and Hughes' (1988) use of length of stay as a measure of health status, as length of stay may also reflect unobservable quality of care.

5. Policy Implications of the Limited Measures Used in Prior Studies

The literature on the effects of competition and consolidation on health care quality is relatively young. Although some empirical studies have been published, most have focused on a limited spectrum of conditions and a limited spectrum of outcome measures. In-hospital mortality and complications have been the most widely used dependent variables, despite the fact that hospitals may respond to competition and other market changes by transferring adverse outcomes from the inpatient setting to the outpatient setting (or vice versa). In addition, these dependent variables are highly susceptible to confounding from unmeasured severity, and may not be as salient to consumers as more patient-centered measures. Only one research team evaluated related process and outcome measures. No researchers have exploited clinical data systems, such as the cardiac surgery data available in New York, New Jersey, and California, to overcome the limitations of using administrative data for risk-adjustment. Endogeneity remains a significant methodologic concern, as

high-quality hospitals may attract patients from outside their immediate neighborhoods and thereby create local markets that appear more competitive, based on the distribution of hospital market shares. In any case, the findings from prior studies have been inconsistent, suggesting that researchers have not yet reached saturation in their empirical efforts to sample the underlying phenomenon. Additional studies applying more quality measures to broader sets of conditions and procedures are likely to be very informative.

The dramatic rise in health care costs has led to increasing policy interest in health care antitrust enforcement. Indeed, the Federal Trade Commission (FTC) has recently undertaken retrospective reviews of several consummated hospital mergers, to increase understanding about the actual effects of such mergers in concentrated markets and to seek remedies in cases where merged hospitals are exercising market power (Leibenluft, 2003). In a comprehensive review of judicial opinions in health care antitrust litigation between 1985 and 1999, Hammer and Sage (2002) found that "courts tend to address quality concerns, if at all, in a fairly abstract manner . . . courts insist on quantitative economic evidence in antitrust litigation, such as sales volume, customer flows, market concentration, price, costs, revenues, and the like . . . (whereas) even relatively well established metrics for health care quality, such as HEDIS scores and other comparative "report card" tools . . . , did not register with courts in our sample." In hospital merger cases, "judges have credited defendants' reputations for quality as support for allowing them to combine, thereby using arguments about quality to achieve a lessening of competition . . . " If the FTC wishes to convince courts that hospital mergers have negative effects on quality, or at least no favorable effects that would outweigh their undesirable effects on price, then more empirical evidence will be necessary. There is ample reason to believe that hospitals respond to financial pressures in ways that may adversely affect quality (Cutler, 1995), but the direction and magnitude of these effects still need to be assessed on a case-by-case basis.

6. Recommendations for Future Research

How can we apply lessons from the evolving science of quality measurement to guide future research and evaluation studies on competition and consolidation in the health care industry? Most importantly, researchers and analysts can now build on years of effort by AHRQ, CMS, JCAHO, NQF, and other organizations to develop reliable and valid measures of hospital quality. Over the next several years, we can anticipate continued evolution of the NQF measure sets and AHRQ's National Healthcare Quality Report as empirical evidence accumulates to support (or refute) the validity of proposed measures. We can also anticipate the increased availability of data for tracking quality measures, especially through such initiatives as the Hospital-CAHPS (Consumer Assessment of Health Plans Survey) consumer survey program, the Hospital Quality Information Initiative cosponsored by the American Hospital Association, the Federation of American Hospitals, and the Association of American Medical Colleges, the 3-State Hospital Pilot Project sponsored by CMS, and the JCAHO's enhanced Quality Reports.[2]

This perspective leads to several recommendations for future research in this field. With an increasing number of officially endorsed quality measures, researchers and analysts should look beyond mortality to evaluate morbidity, patient experiences, and other explicit

processes of care. Implicit process measures seem less useful because they are costly to collect and susceptible to bias, unless reviewers can be blinded to the characteristics and identities of the hospitals being evaluated. Structural measures also seem less useful, because hospital mergers may affect these measures without improving or compromising the actual quality of care. Outcome measures that cover the early post-discharge period (i.e., 30 to 90 days) may be especially helpful to remove bias due to variation in length of stay and transfer practices. Finally, any set of measures should tap into multiple clinical domains, especially those likely to be affected by the integration or unnecessary duplication of clinical services.

Of course, as the number of quality measures being evaluated increases, so does the cumulative risk of making at least one type I error (i.e., rejecting the null hypothesis of no effect when the null hypothesis is actually true). Whether and how to correct for multiple comparisons remains a controversial issue in population research (Rothman 1990; Savitz and Olshan, 1995; Thompson 1998). Although it may be premature to dismiss unexpected but meaningful findings related to the impact of competition by restricting the number of measures or adjusting our boundaries for rejecting the null hypothesis, we also must avoid getting excited about anomalous findings that do not fit with any conceptual framework or prior studies. Accordingly, we need to develop a theory that can help us select quality measures that may be especially sensitive to the effects of competition and consolidation. In the following subsections, we briefly explore the implications of three pathways by which competition may affect quality of care.

6.1. Hospitals Compete on True Quality

If hospitals in competitive markets compete on true quality, then consolidation should lead to decreased quality. In this case, we would expect the greatest effects for measures that are observable to consumers, payers, and referring physicians. The subset of observable measures varies across states and communities. For example, statewide data on hospitals' risk-adjusted CABG mortality is now available in New York, New Jersey, Pennsylvania, and California.[3] Statewide data on procedure- and condition-specific mortality (based on the AHRQ Inpatient Quality Indicators) is publicly available in New York and Texas.[4] Statewide data on patients' experiences with hospital care, including seven important domains (i.e., respect for patient preferences, coordination of care, information and education, physical comfort, emotional support, involvement of family and friends, and transition to home), is publicly available in California and Massachusetts.[5] Hibbard, Stockard, and Tusler (2003) showed that hospitals in Wisconsin responded to public reporting of complication rates by implementing quality improvement programs focused on those complications.[6] We expect these effects to be more pronounced in competitive markets than in concentrated markets. In other words, we should find that public reporting interacts to enhance the effects of competition on reported outcome measures, while competition enhances the effects of public reporting.

Of course, these enhanced effects may be functional, mediated through process improvement, or dysfunctional, mediated through "cream-skimming" or other undesirable behaviors (Gormley and Weimer, 1999). If there are multiple observable measures in a community,

patient-centered measures such as satisfaction and experiences with care should be more sensitive to competition and consolidation than provider-centered measures, because the former are more salient to consumers (Hibbard and Jewett, 1997). Finally, as Gaynor (2003) suggests, we expect to find greater effects of competition on quality when prices are fixed, as for Medicare patients, than when prices are variable. If prices vary, and payers are sensitive to price, then providers may compete on price rather than quality.

6.2. Hospitals Compete Primarily on Amenities

If hospitals in competitive markets compete primarily on amenities, or what Mukamel, Zwanziger and Bamezai (2002) describe as "hotel services," then consolidation should lead to increased clinical quality by allowing hospitals to direct resources away from amenities toward quality-enhancing activities. Hospitals in competitive markets would be expected to neglect the process and outcome measures described above, and focus their attention instead on signaling activities that demonstrate their commitment to quality and service and increase their attractiveness to referring physicians. Indeed, several studies showed that competition among hospitals before the advent of selective contracting and prospective payment led to a "medical arms race" in which hospitals competed by investing in new technologies, operating duplicative clinical services, and accommodating patients' and physicians' preferences for longer stays (Robinson and Luft, 1987; Robinson, Garnick and McPhee, 1987; Luft et al., 1987; Robinson et al., 1988). Although this "medical arms race" subsided in favor of price competition during the mid-to-late 1980s (Melnick and Zwanziger, 1988; Zwanziger and Melnick, 1988; Mukamel, Zwanziger and Bamezai, 2002), recent changes in the structures of the hospital and health insurance markets appear to have caused a return to non-price based competition and the "medical arms race" in the late 1990s (Devers, Brewster and Casalino, 2003; Nichols et al., 2004; Rosko, 2001).

6.3. Hospital Volume and Experience Dominate Other Market Effects on Quality

Finally, any direct effect of competition on quality may be swamped by the effect of volume or experience. If the "practice makes perfect" hypothesis is correct, then virtually any market changes that reduce competition and regionalize high-risk procedures into high-volume centers will improve patient outcomes. Therefore, it may be especially important to evaluate outcomes for which provider experience appears to be very important, such as AIDS treatment and surgery for pancreatic cancer, esophageal cancer, abdominal aortic aneurysms, and pediatric congenital heart disease (Halm, Lee and Chassin, 2002; Dudley et al., 2000). If increasing competition has any deleterious effects on quality, we would expect those effects to be most prominent in conditions for which quality is closely linked to volume and experience. Of course, not all hospital mergers are equivalent, so it will be important to distinguish mergers in which hospitals rationalize their services and concentrate volume for high-risk procedures from mergers in which hospitals maintain completely separate clinical programs.

6.4. Final Conclusions

The evolving science of hospital quality measurement has significant implications for studies on the impact of competition and consolidation in the hospital industry. In an era of rapidly rising health care costs, researchers and policy analysts will need to apply both process and outcome measures of quality to better define the role of competition in protecting or improving hospital quality. Researchers and policy analysts will also need to apply newer patient-centered measures in addition to traditional mortality and morbidity measures. These measures will need to come from multiple data sources, including not just hospital discharge data, but also disease-specific reporting systems for cardiac surgery in New York, New Jersey, Pennsylvania, and California; reporting systems for patients' experiences such as NRC Picker surveys in California and Massachusetts and the forthcoming Hospital-CAHPS program; and process-of-care reporting systems based on JCAHO's hospital performance measures. Finally, future analyses of hospital competition and quality should be guided by at least one of the three conceptual frameworks described above. Such studies will elucidate the specific circumstances in which hospital consolidation is likely to improve quality of care, compromise quality, or affect price but not quality. Federal antitrust agencies will then focus their limited resources on mergers that are likely to increase prices without improving quality, while state health agencies will be able to impose conditions on hospital behavior to avert potentially negative effects on quality.

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Notes

1. See http://www.qualitytools.ahrq.gov/ for the 2003 National Healthcare Quality Report and National Healthcare Disparities Report.
2. See http://www.ahrq.gov/qual/cahpsix.htm for information about the Hospital-CAHPS program, http://www.cms.hhs.gov/quality/hospital/hqii.asp for information about the Hospital Quality Information Initiative, http://www.cms.hhs.gov/quality/hospital/hspp.asp for information about the CMS 3 State Hospital Pilot Project (Maryland, Arizona, and New York), and http://www.jcaho.org/accredited+organizations/svnp/ for information about the Joint Commission's "Shared Visions-New Pathways " accreditation initiative, which includes dissemination of enhanced Quality Reports.
3. For cardiac surgery outcomes reports, see http://www.health.state.ny.us/nysdoh/heart/heart_disease.htm for New York, http://www.state.nj.us/health/hcsa/cabmenu.htm for New Jersey, http://www.phc4.org/idb/Cabg/default.cfm for Pennsylvania, and http://www.oshpd.state.ca.us/hqad/HIRC/hospital/Outcomes/CABG/index.htm for California.
4. For reports using AHRQ's Inpatient Quality Indicators, see http://www.myhealthfinder.com/ for New York and http://www.thcic.state.tx.us/IQIReport2001/IQIReport2001.htm for Texas.

5. For reports on patients' experiences with hospital care, based on the NRC Picker survey, see http://www.calhospitals.org/ for California and http://www.mhqp.org/TABLE.html for Massachusetts.
6. For reports on patient safety and complications in Wisconsin, see http://www.qualitycounts.org/QCReport_2001.pdf.

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