Systematic Review: The Evidence That Publishing Patient Care Performance Data Improves Quality of Care

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Background: Previous reviews have shown inconsistent effects of publicly reported performance data on quality of care, but many new studies have become available in the 7 years since the last systematic review.

Purpose: To synthesize the evidence for using publicly reported performance data to improve quality.

Data Sources: Web of Science, MEDLINE, EconLit, and Wilson Business Periodicals (1999–2006) and independent review of articles (1986–1999) identified in a previous systematic review. Only sources published in English were included.

Study Selection: Peer-reviewed articles assessing the effects of public release of performance data on selection of providers, quality improvement activity, clinical outcomes (effectiveness, patient safety, and patient-centeredness), and unintended consequences.

Data Extraction: Data on study participants, reporting system or level, study design, selection of providers, quality improvement activity, outcomes, and unintended consequences were extracted.

Data Synthesis: Forty-five articles published since 1986 (27 of which were published since 1999) evaluated the impact of public reporting on quality. Many focus on a select few reporting systems. Synthesis of data from 8 health plan–level studies suggests modest association between public reporting and plan selection. Synthesis of 11 studies, all hospital-level, suggests stimulation of quality improvement activity. Review of 9 hospital-level and 7 individual provider–level studies shows inconsistent association between public reporting and selection of hospitals and individual providers. Synthesis of 11 studies, primarily hospital-level, indicates inconsistent association between public reporting and improved effectiveness. Evidence on the impact of public reporting on patient safety and patient-centeredness is scant.

Limitations: Heterogeneity made comparisons across studies challenging. Only peer-reviewed, English-language articles were included.

Conclusion: Evidence is scant, particularly about individual providers and practices. Rigorous evaluation of many major public reporting systems is lacking. Evidence suggests that publicly releasing performance data stimulates quality improvement activity at the hospital level. The effect of public reporting on effectiveness, safety, and patient-centeredness remains uncertain.

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Although recent reports on the quality of U.S. health care document improvement in many clinical areas (1, 2) quality deficits remain (3–5). Studies suggest that the U.S. health care system often fails to deliver effective (3), safe (6–9), and patient-centered care (10, 11)—3 areas that the Institute of Medicine has identified as important for a well-functioning health care system (12).

Lack of a transparent, explicit, systematic, data-driven performance measurement and feedback mechanism for health care providers has contributed to these failures (13, 14). Unlike information on quality of services and products, such as universities (15) and restaurants (16), U.S. consumers have limited access to information on health care providers, even though studies suggest an interest in comparative information (17–19). The public release of performance data has been proposed as a mechanism for improving quality of care (20–22) by providing more transparency and greater accountability of health care providers (13). According to Berwick and colleagues' framework for quality improvement (23), public reporting can improve performance through 2 pathways, which are interconnected by a provider's motivation to maintain or increase market share (**Figure 1**). In the selection pathway, patients or their intermediaries compare publicly released performance data and reward the better-performing providers by "selecting" (rewarding, recognizing, punishing, or paying) the provider. In the change (or quality improvement) pathway, performance data help providers identify areas in which they underperform and improve their performance (23, 24).

Over the past decade, reporting systems that summarize publicly released performance data have proliferated (25, 26). In 2000, Marshall and coauthors (27) performed a systematic review on the use and impact of publicly released performance data. They noted that studies on the topic were scant and found that several reporting systems were evaluated repeatedly, and they concluded that hospitals seem to be most responsive to the data. In 2001, Schauffler and Mordavsky (28) concluded that publicly reported performance data did not meaningfully affect decision making, quality improvement activity, or competition.

Since the publication of these 2 systematic reviews, many studies of publicly reported performance data have been published. We therefore performed a systematic re-

See also:

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Appendix Tables
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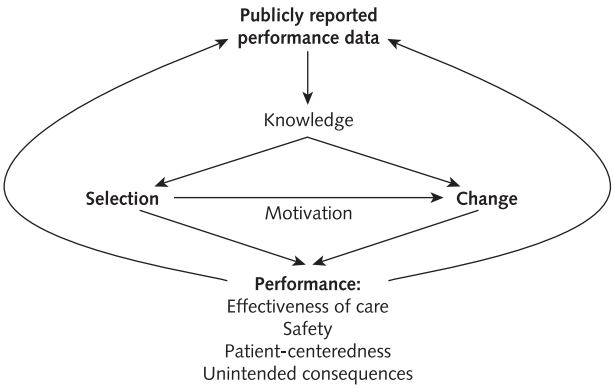
Figure 1. **Two pathways for improving performance through release of publicly reported performance data.**



Information from reference 23.

view 1) to synthesize the evidence for using publicly reported performance data to stimulate quality improvement activity, affect selection of providers, and improve clinical outcomes (effectiveness, patient safety, and patient-centeredness), and 2) to assess the evidence for unintended consequences.

METHODS

Data Sources

Data sources included Web of Science, MEDLINE, EconLit, and Wilson Business Periodicals Abstracts. A professional librarian started with a "forward search" of Web of Science (Science and Social Science Citation Indexes) database on 2 seminal articles on public reporting that have extensive reference lists: Marshall and coauthors' systematic review (27) and Schneider and Lieberman's review (29). Additional searches of MEDLINE, EconLit, and Wilson Business Periodicals Abstracts by using keywords (**Appendix Table 1**, available at www.annals.org) complemented this initial forward search strategy. We also searched the references of 3 published review papers (28, 30–32) and 1 unpublished working paper by experts in the field (Romano PS, Rainwater J, Marcin JP. Review of the literature on the impact of public reporting of CABG surgery outcomes. In preparation.). Because Marshall and coauthors' review (27) included articles published between January 1986 and October 1999, we limited our database search to articles published between January 1999 and March 2006.

For articles published before 1999, our sampling frame was the reference list of Marshall and coauthors' systematic review (27). We judged this sampling frame to be adequate because the scope of their review was broader than that of our paper in that it covered not only the topic we sought to assess but also use of publicly reported performance data and the impact on costs in diverse populations. We also examined references cited in Schauffler and Mordavsky's review (28) and contacted experts on public reporting. Only English-language articles were included.

Study Selection

Three investigators discussed the inclusion criteria until consensus was achieved, refining coding conventions and the types of data that would be abstracted. Two authors independently evaluated articles for potential inclusion. We included articles that provided empirical evidence on the impact of public reporting on outcomes (effectiveness, patient safety, and patient-centeredness) and unintended consequences, as well as the selection and quality improvement activity ("change") pathways (23). **Table 1**, **Table 2**, and **Appendix Table 2** (available at www.annals.org) show the designs of eligible studies. We excluded opinion and theory articles, review articles, non–English-language articles, historical descriptions, and articles on awareness or comprehension of publicly reported performance data that did not also measure a change in the 2 pathways, outcomes, or unintended consequences.

Data Extraction

Two authors independently assessed all qualifying studies for information on design, participants, reporting system (for example, QualityCounts), reporting level (health plan, hospital, medical group, or individual provider), impact on selection of provider or quality improvement activity, changes in outcomes (effectiveness of care, patient safety, and patient-centeredness), and unintended consequences. We resolved disagreements through discussion.

Quality Assessment

To assess methodological quality, 3 authors tested and revised appraisal criteria adapted from assessments of quality improvement interventions (33, 34). Two authors independently assessed articles for each item on our final appraisal checklist, which included 3 domains. Disagreements were resolved by discussion with a third author. For the first domain (study participants or reporting system), we rated on a 4-point scale how closely the participants or reporting system overlap with the characteristics and needs of the privately insured or Medicare population—2 groups that represent the majority of the U.S. population and would probably be the target of most major public reporting initiatives; on this scale, 4 stars indicate complete overlap and 1 star indicates no overlap). For the second domain (study design), we also created 4 categories (in which 4 stars indicate the strongest design and 1 star indicates the weakest). For the third domain, a global rating modeled after the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) system (35), we indicated whether the study should carry great (3 checks), moderate (2 checks), or little (1 check) weight when considering the strength of evidence. This global rating integrated our ratings of the first 2 domains, as well as pene

tration of report card use (adherence), dose–response gradient, precision and validity of outcomes, and uncertainty about direction of the results. All studies were eligible to receive high global ratings, even though such outcomes as effectiveness may be more direct measures of quality than, for example, increased selection of health plans. Data were too heterogeneous to support quantitative pooling.

Role of the Funding Source

RAND Health's Comprehensive Assessment of Reform Options Initiative, which receives funding from RAND's corporate endowment, individual donors, corporations, foundations, and other organizations, supported this project. Only RAND Health staff played a role in the design, conduct, and reporting of the study.

Results

Identification of Evidence

Our literature searches identified 2543 titles, from which we selected 143 articles for more detailed review. From these, we identified 14 articles that met our inclusion criteria. For articles published before 1999, we selected 18 of the 31 articles retrieved from Marshall and coauthors' review (27). The other 13 articles focused on comprehension and perceived usefulness of report cards and impact on costs, which were not the focus of our review. We identified an additional 13 articles through review of reference lists or contacting experts. Thus, we identified 45 pertinent articles (of which 27 were not included in Marshall and coauthors' review) (**Figure 2**).

Table 1, **Table 2**, and **Appendix Table 2** (available at www.annals.org) summarize our findings and ratings of each article. We organize our findings by reporting level. Within each level, we describe the effect on selection of providers, quality improvement activity, outcomes (effectiveness, patient safety, and patient-centeredness), and unintended consequences. Overall, health plan–level studies had higher global ratings than hospital-level or individual provider–level studies. Quality improvement activity studies, on average, had low global ratings. Outcome studies overall had medium global ratings. Several reporting systems, most notably the New York State Cardiac Surgery Reporting System (NYS CSRS) and the Cleveland Health Quality Choice (CHQC) Program, were evaluated multiple times.

Health Plans

Selection

Eight studies published after 1999 provide mixed conclusions about the effects of public reporting on selection of health plans.

Three studies focused solely on data from the Consumer Assessment of Healthcare Providers and Systems (CAHPS) survey, which describes patients' experiences with care (36). Two randomized, controlled trials (37, 38) of Medicaid beneficiaries' plan choices found no effect of CAHPS data on health plan selection overall. In a subgroup analysis, participants who read the report and chose an HMO with dominant market share selected plans with higher CAHPS scores compared with the control group (37). Spranca and associates (39), who used an experimental design involving hypothetical performance ratings, found that consumers in general preferred more expensive plans with better coverage but were willing to accept plans with less generous coverage if the health plan had high CAHPS ratings. Also using hypothetical plan performance ratings, Harris (40) found that people were willing to trade access restrictions for higher quality.

Four studies used longitudinal observational data and econometrics models to examine the impact of providing health plan performance data. Beaulieu (41) found that Harvard University employees in plans with lower reported quality were more likely to switch plans than those enrolled in higher-quality plans. In Wedig and Tai-Seale's study of federal employees (42), a 1-SD increase in quality-of-care score was associated with an increased likelihood (>50%) of plan selection. Jin and Sorenson (43) found that among federal employees, a 1-SD increase in a quality score was associated with a 2.63–percentage point increase in the likelihood of plan selection, although employees overall did not switch plans. Scanlon and coworkers (44) found that General Motors employees avoided plans with below-average ratings but were not strongly attracted to plans with superior ratings.

Quality Improvement Activity

We identified no studies of health plan performance data and quality improvement activity.

Clinical Outcomes and Unintended Consequences

In a retrospective cohort study using unadjusted data, Bost (45) found that health plans that voluntarily report performance data outperformed non–publicly reporting plans in technical (Health Employer Data and Information Set) and patient experience (CAHPS courtesy and customer service measures) domains. In a retrospective cohort study, McCormick and colleagues (46) found that plans with lower quality-of-care scores are more likely than higher-scoring plans to stop publicly reporting their quality data (odds ratio, 3.6 [95% CI, 2.1 to 7.0]).

Hospitals

Selection

We identified 4 studies published at the time of Marshall and coauthors' review (27) and 5 new studies. Overall, publicly reporting performance data did not affect selection of hospitals.

Early reports focused on publicly released hospital mortality rates from the Health Care Financing Administration (now the Centers for Medicare & Medicaid Services). In a retrospective cohort study that used econometrics models, Mennemeyer and associates (47) reported that releasing hospital-specific mortality rates was associated with small but statistically significant effects on utilization,

Table 1. **Effect of Public Release of Performance Data on Health Plan Quality***

Study, Year (Reference)†	Objective	Domain 1: Sample		
		Subject of Public Reporting	Participants	Rating‡
Selection				
Farley et al., 2002 (37)	To assess effects of providing CAHPS information on plan choices	HMO Medicaid plans in New Jersey	Medicaid beneficiaries (1998)	★★★
Farley et al., 2002 (38)	To assess effects of providing CAHPS information on plan choices	HMO Medicaid plans in Iowa	Medicaid beneficiaries (2000)	★★★
Spranca et al., 2000 (39)	To assess effects of providing CAHPS information about hypothetical health plans on plan choices	Hypothetical plans (Los Angeles; laboratory setting)	Adults with private insurance	★★
Beaulieu, 2002 (41)	To assess effects of providing health plan performance data (HEDIS measures, patient satisfaction) on consumers' enrollment decisions	Private health plans available to Harvard University employees	Harvard University employees (1994–1997)	★★★
Wedig and Tai-Seale, 2002 (42)	To assess effects of providing quality ratings from the Federal Employee Health Benefit guide on consumers' plan choices	Private health plans available to U.S. federal employees	Federal employees with HMO coverage residing in counties with ≤5 unique plans (1995–1996)	★★★
Jin and Sorenson, 2006 (43)	To assess effects of providing quality ratings from the Federal Employee Health Benefit guide on plan choices	Private health plans serving U.S. federal employees	Federal employees, retirees, and surviving family of deceased federal employees (1998–1999)	★★★★
Scanlon et al., 2002 (44)	To assess effects of providing HEDIS and patient satisfaction ratings on plan choices	Private health plans (HMO only) at General Motors	General Motors employees (1996–1997)	★★★
Harris, 2002 (40)	To investigate the impact of expert-assessed and consumer-assessed quality ratings on willingness to enroll in hypothetical health plans that restrict provider access	Hypothetical plans (Los Angeles; laboratory setting)	Privately insured adults (2000)	★★
Clinical outcome				
Bost, 2001 (45)	To compare HEDIS and CAHPS results for plans that publicly report data with those who do not, over a 3-year period	U.S. commercial health plans	Commercial health plans (1997–1999)	★★★★
Unintended consequences				
McCormick et al., 2002 (46)	To assess the relationship between health plan performance and participation in public reporting programs	U.S. commercial health plans (HMO only)	HMO health plans (1997–1999)	★★★

* CAHPS = Consumer Assessment of Healthcare Providers and Systems; HEDIS = Health Employer Data and Information Set.
† No studies of health plan performance data and quality improvement activity were identified.
‡ Samples with 4 stars were representative of the population in whom public reporting is contemplated; those with 3 stars had major overlap between the targeted sample and the population in whom public reporting is contemplated; those with 2 stars had a narrow set of characteristics that differs from that of the population in whom public reporting is contemplated; and those with 1 star were completely different from the population in whom public reporting is contemplated.
§ Four stars indicate a randomized trial or experimental study; 3 stars indicate a controlled trial, pre–post trial with control (controlled before–after trial), time series, or observational cohort with multivariable adjustment; 2 stars indicate a pre–post trial without control, observational cohort study without multivariable adjustment, cross-sectional study without multivariable adjustment, analysis of time trends without control, or well-designed qualitative study; and 1 star indicates a case series, other qualitative study, or survey (descriptive) study.
‖ Three checks indicate great weight in the stratum's body of evidence, 2 checks indicate moderate weight, and 1 check indicates little weight.

whereas press reports of single, unexpected deaths were associated with a relatively large effect. Vladeck and colleagues (48) compared occupancy rates by using 1-way analysis of variance and found that the Health Care Financing Administration data did not statistically significantly affect rates between high- and low-mortality hospitals.

Several articles describe the effect of the NYS CSRS, which reports risk-adjusted mortality rates associated with

Table 1—**Continued**

Domain 2: Design		Key Findings	Global Rating‖
Type	**Rating§**		
Randomized, controlled trial	★★★★	No effect on HMO choices overall; participants who read the report card and did not select the dominant HMO chose the HMO with higher CAHPS scores	√√√
Randomized, controlled trial	★★★★	No effect on HMO choices overall	√√
Experimental study	★★★★	When plans had high CAHPS ratings, participants were willing to enroll in less expensive plans that restrict services	√√
Observational cohort	★★★	Provision of quality information had a small but statistically significant effect on health plan choices	√√
Observational cohort	★★★	Dissemination of report cards influenced plan selection; employees were more likely to select plans with better quality ratings	√√
Observational cohort	★★★	Overall inertia in health plan enrollment decisions; for individuals affected by performance ratings, better scores were associated with increased likelihood of selecting the plan	√√√
Observational cohort	★★★	Employees avoided plans with many below-average ratings and would be willing to pay more to avoid plans with lower ratings, but they were not strongly attracted to plans with many superior ratings	√√√
Experimental study	★★★★	Provision of report cards with information about quality of health plan reduced importance of provider network features	√√
Observational cohort	★★	Technical performance measures and patient experience measures (except communication) were higher for health plans that publicly report data	√
Observational cohort	★★★	Lower-scoring plans are more likely than higher-scoring plans to stop disclosing publicly their quality data	√√

coronary artery bypass graft (CABG) surgery, on selection of hospitals (measured as change in market share). Most analyses suggest no or modest effects on market share. Using ordinary least-squares techniques that did not include adjustment for confounders, Mukamel and Mushlin (49) found that providers with better outcomes had higher growth rates in market share than those with poorer outcomes. In contrast, Hannan and coworkers (50), who compared unadjusted volumes over 4 years, found no changes in hospital surgical volume associated with mortality rates. Chassin (51), who analyzed the unadjusted market share of high- and low-mortality outlier hospitals for the year before they were named as outliers and the year after (1989 to 1995), concluded that changes were small but presented no formal statistical test results. Jha and Epstein (52) also found no evidence that the NYS CSRS had a meaningful impact on hospitals' market share.

Studies of other reporting systems show mixed results. Using multivariable linear regression models, Baker and associates (53) examined the impact of the CHQC Program on market share (number of hospital discharges). The CHQC Program included reports of severity-adjusted

Table 2. **Effect of Public Release of Performance Data on Individual Provider Quality***

Study, Year (Reference)†	Objective	Domain 1: Sample			Domain 2: Design		Key Findings	Global Rating‖
Selection		Subject of Public Reporting	Participants	Rating‡	Type	Rating§		
Mukamel et al., 2004 (73)	To examine the impact of the NYS CSRS on selection of cardiac surgeons	All New York cardiac surgeons performing CABG	All New York Medicare fee-for-service enrollees ≥65 years of age who underwent CABG (1991–1992)	★★★	Observational cohort	★★★	For the average patient, the NYS CSRS influenced selection of cardiac surgeon and diminished the importance of surgeon experience and price as signals for quality	√√
Mukamel and Mushlin, 1998 (49)	To measure the relationship between provider ratings in the NYS CSRS and rates of growth in fee-for-service market share	All New York cardiac surgeons performing CABG	New York cardiac surgeons with a Unique Physician Identification Number (1990–1993)	★★★	Observational cohort	★★	Physicians with better outcomes had higher rates of growth of charges	√
Hannan et al., 1994 (50)	To determine whether mortality rate outlier status was associated with overall improvement in risk-adjusted mortality and changes in volume of CABG operations following the implementation of the NYS CSRS	All New York cardiac surgeons performing CABG	New York cardiac surgeons (1989–1992)	★★★★	Observational cohort	★★★	Surgeon group volume did not change substantially (exact figures were not presented)	√√
Hannan et al., 1995 (74)	To examine the longitudinal relationship between surgeon volume and in-hospital mortality for CABG surgery in New York and explain changes in mortality over time	All New York cardiac surgeons performing CABG	57 187 patients undergoing isolated CABG surgery in New York (1989–1992)	★★★★	Observational cohort	★★★	Percentage of patients undergoing CABG surgery by low-volume surgeons decreased from 7.6% in 1989 to 5.7% in 1992	√√
Jha and Epstein, 2006 (52)	To examine the relationship between providers' NYS CSRS rankings and market share; to examine impact of cardiac surgeons' performance on the likelihood of ceasing practice in New York	All New York cardiac surgeons performing CABG	All New York cardiac surgeons who dropped out of the reporting system (1989–1999)	★★★★	Observational cohort	★★★	Poor performance was associated with increased odds of ceasing practice	√√
Mukamel et al., 2000 (75)	To use telephone interviews and contracting data from the majority of MCOs licensed in New York to determine whether New York MCOs consider quality when they choose cardiac surgeons and whether NYS CSRS affects contracting patterns	All New York cardiac surgeons performing CABG	Decision makers within MCOs who are responsible for the selection of providers in New York (59% response rate) (1998)	★★★	Cross-sectional study	★★	20% indicated that the NYS CSRS reports were a major factor in their contracting decision; actual contracting patterns show that MCOs contract on the basis of a surgeon's designation as a high-quality outlier, but they do not make choices on the basis of poor-quality outlier designation or actual RAMR	√
Mukamel et al., 2002 (76)	To evaluate the association between contracting practices of MCOs with cardiac surgeons and the quality of the cardiac surgeons	All New York cardiac surgeons performing CABG	Cardiac surgeons offering CABG surgery and 78% of MCOs in New York (1998)	★★★	Observational cohort	★★★	Contract probability decreased with excess RAMR and increased with high-quality outlier status in downstate New York	√√

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Table 2—**Continued**

Study, Year (Reference)†	Objective	Domain 1: Sample			Domain 2: Design		Key Findings	Global Rating‖
Selection		Subject of Public Reporting	Participants	Rating‡	Type	Rating§		
Clinical outcome								
Hannan et al., 1994 (50)	To determine whether mortality rate outlier status was associated with changes in CABG-related in-hospital RAMRs and changes in provider volume of CABG performed after implementation of the NYS CSRS	All New York cardiac surgeons performing CABG	New York cardiac surgeons (1989–1992)	★★★★	Observational cohort	★★★	When providers were split into terciles based on RAMR, the 3 groups showed different risk-adjusted mortality for the prerelease period; RAMR decreased for all groups after release; when terciles were based on outlier status, the middle and highest outliers had a decrease in RAMR and the lowest outlier group had a slight increase in RAMR	√√
Unintended consequences								
Schneider and Epstein, 1996 (77)	To assess the influence of the Pennsylvania Consumer Guide to CABG Surgery on cardiologists and cardiac surgeons	All Pennsylvania cardiac surgeons performing CABG	Randomly selected cardiologists and cardiac surgeons practicing in Pennsylvania (65% overall response rate) (1995)	★★★	Descriptive (survey)	★	59% of cardiologists reported increased difficulty finding surgeons willing to perform CABG in severely ill patients who required it; 63% of cardiac surgeons reported being less willing to operate on such patients	√
Burack et al., 1999 (78)	To examine the effects on the practice of cardiac surgery, as perceived by surgeons	All New York cardiac surgeons performing CABG	104 New York cardiac surgeons (69% response rate) (1997)	★★★	Descriptive (survey)	★	62% of cardiac surgeons refused to operate on ≥1 high-risk CABG patient over the preceding year, primarily because of public reporting	√
Werner et al., 2005 (80)	To investigate the impact of the NYS CSRS on racial and ethnic disparities in use of CABG, PTCA, and cardiac catheterization	All New York hospitals and cardiac surgeons performing CABG	Hospital discharges from the New York State Department of Health's inpatient data files and hospital discharges in a group of comparison states in the Nationwide Inpatient Sample from the HCUP-3 (928 551 patients with acute myocardial infarction) (1988–1995)	★★★★	Observational cohort	★★★	Racial and ethnic disparity in CABG use increased in New York immediately after implementation of the NYS CSRS, whereas disparities did not change in the comparison states; these disparities decreased to levels similar to report card prerelease levels over time; no differences in PTCA or cardiac catheterization after the CABG report card was released	√√
Narins et al., 2005 (79)	To assess the influence of the New York PCI report on physicians being monitored	All New York physicians and hospitals performing PCI	Interventional cardiologists included in the New York State PCI report (65% response rate) (2003)	★★★	Descriptive (survey)	★	79% of interventional cardiologists agreed or strongly agreed that public reporting has influenced their decision on whether to perform angioplasty on individual patients and critically ill patients with high expected mortality rates	√

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Table 2—**Continued**

Study, Year (Reference)†	Objective	Domain 1: Sample			Domain 2: Design		Key Findings	Global Rating‖
Selection		Subject of Public Reporting	Participants	Rating‡	Type	Rating§		
Mukamel et al., 2004 (73)	To examine the impact of the NYS CSRS on selection of cardiac surgeons	All New York cardiac surgeons performing CABG	All New York Medicare fee-for-service enrollees ≥65 years of age who underwent CABG (1991–1992)	★★★	Observational cohort	★★★	In the postreport period, patients from more affluent and more educated neighborhoods were more likely to be treated by low RAMR surgeons, and patients from lower socioeconomic neighborhoods were more likely to be treated by high RAMR surgeons	√√
Hannan et al., 1995 (74)	To examine the longitudinal relationship between surgeon volume and in-hospital mortality for CABG surgery in New York and explain changes in mortality over time	All New York cardiac surgeons performing CABG	57 187 patients undergoing isolated CABG surgery in New York (1989–1992)	★★★★	Observational cohort	★★★	Proportionately larger decrease in RAMR for low-volume surgeons was not due to changes in patient case mix; the decrease was due in part to an exit of high RAMR surgeons from clinical practice and an influx of low RAMR surgeons	√√

* CABG = coronary artery bypass graft; HCUP-3 = Healthcare Cost and Utilization Project-3; MCO = managed care organization; NYS CSRS = New York State Cardiac Surgery Reporting System; PCI = percutaneous coronary intervention; PTCA = percutaneous transluminal coronary angioplasty; RAMR = risk-adjusted mortality rate.
† No studies of individual provider quality and quality improvement activity were identified.
‡ Samples with 4 stars were representative of the population in whom public reporting is contemplated; those with 3 stars had major overlap between the targeted sample and the population in whom public reporting is contemplated; those with 2 stars had a narrow set of characteristics that differs from that of the population in whom public reporting is contemplated; and those with 1 star were completely different from the population in whom public reporting is contemplated.
§ 4 stars indicate a randomized trial or experimental study; 3 stars indicate a controlled trial, pre–post trial with control (controlled before–after trial), time series, or observational cohort with multivariable adjustment; 2 checks indicate a pre–post trial without control, observational cohort study without multivariable adjustment, cross-sectional study without multivariable adjustment, analysis of time trends without control, or well-designed qualitative study; and 1 star indicates a case series, other qualitative study, or survey (descriptive) study.
‖ 3 checks indicate great weight in the stratum's body of evidence, 2 checks indicate moderate weight, and 1 star indicates little weight.

mortality rates, cesarean section deliveries, patient satisfaction, and length of stay. They found that high-mortality outlier hospitals did not experience a statistically significant change in adjusted market share. In a study that used multivariable linear and autoregressive models to study the impact on acute myocardial infarction–, lumbar diskectomy–, and CABG-related volume, Romano and Zhou (54) found the effects of the California and New York State public reporting initiatives to be selective and short term. Hibbard and colleagues (55) studied the effect of the QualityCounts public-reporting initiative, which reports summary indices of adverse events, on market share (number of hospital discharges). Examining changes in the proportion of unadjusted discharges from the prereporting to the postreporting period, the authors concluded that the program made no meaningful change in market share.

Quality Improvement Activity

Synthesis of 11 studies that assessed the effect of publicly releasing performance data on quality improvement activity (5 of which were published since 1999) suggests that public reporting stimulates quality improvement activity.

Three studies described the effects of publicly releasing CABG surgery mortality performance data on quality improvement activity. Through a series of interviews, Chassin (51) found that some New York hospitals with high mortality rates took measures to improve their cardiac surgery programs. Dziuban and colleagues (56) described a mortality pattern analysis and changes in practice patterns that occurred in a New York hospital after it was identified as a high-mortality outlier. Using a cross-sectional survey of key informants, Bentley and Nash (57) reported hospital monitoring of clinicians' performance as a result of the release of CABG mortality in Pennsylvania (Pennsylvania Health Care Cost Containment Council project).

Two studies by Hibbard and associates (31, 55) evaluated the impact of QualityCounts on quality improvement activity. In the first study (31), the authors used analysis of variance to compare the quantity of quality improvement activities in hospitals that were subject to public reporting with those receiving confidential feedback or no

feedback. Making performance information public stimulated quality improvement activities in domains included in the reports. In the second study (55), the authors described the average number of quality improvement activities among the hospitals listed in the public report and observed that these numbers were greater among hospitals with improved performance scores.

Additional articles described the effects of other public reporting systems on quality improvement activity. In a case series, Rosenthal and coworkers (58) described quality improvement activities in several Cleveland hospitals that occurred in response to CHQC reports. In a descriptive study, Tu and Cameron (59) found that more than half of the hospitals responded to a Canadian hospital-specific report on acute myocardial infarction by implementing quality improvement activities. In a study that described quality improvement activity after implementation of Missouri's Consumer Obstetrics Report Card, Longo and associates (60) reported process improvement efforts, such as seat belt programs. In contrast, Luce and colleagues (61), who also used survey methods, found that only 3 of 17 acute-care California public hospitals initiated quality improvement activities in response to release of risk-adjusted outcomes by the California Hospital Outcomes Project (CHOP). Rainwater and coworkers (62), in a survey of hospital leaders, found that the CHOP reports did not directly affect processes of care for acute myocardial infarction, although some leaders reported studying the outcome data to identify areas for improvement (and some said that they changed processes because of poor ratings).

Although many of the studies found favorable quality improvement activity, the case series study by Mannion and colleagues (63) found several instances in England in which public reporting provided disincentives for improvement, although report card ratings were helpful in aligning internal quality improvement objectives with national targets.

Clinical Outcomes and Unintended Consequences

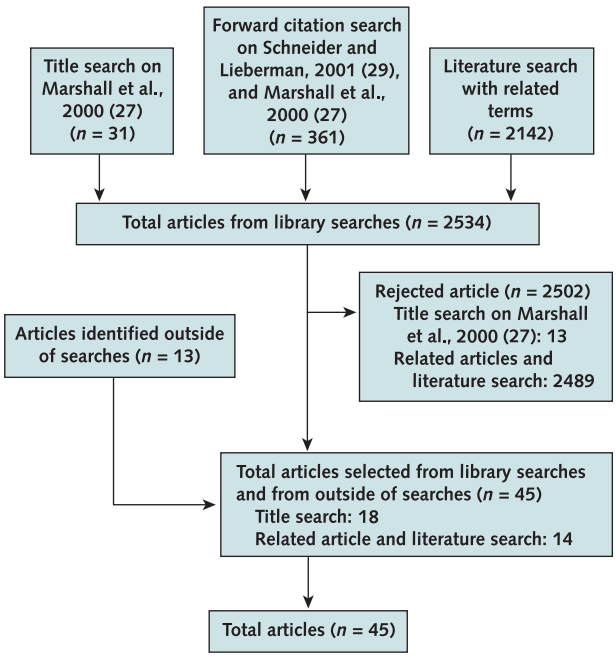
Eleven studies that assessed the effect of public performance data on outcomes (4 of which were published since 1999) provide mixed evidence for using publicly released performance results to improve outcomes.

Six of the 11 studies, which ranged from a case study design to more rigorous study designs that included control groups, assessed the impact of cardiac public reporting programs in New York on hospital mortality. Definitions of mortality (risk-adjusted vs. unadjusted, in-hospital vs. 30-day) and conclusions varied among studies. Dziuban and coworkers (56) found that the risk-adjusted mortality improved from 6.6% to 1.8% in 1 New York hospital. Hannan and colleagues (64) reported a reduction in risk-adjusted mortality rates from 4.17% to 2.45% in all New York hospitals after implementation of the NYS CSRS, although the analysis did not account for secular trends or migration in or out of the state. In another study that did not apply methods to account for secular trends or migration, Hannan and colleagues (50) reported that providers with the highest initial mortality rates improved the most and that risk-adjusted mortality rates no longer differed among hospitals with the highest, middle, and lowest mortality rates after release of the reports. However, Ghali and coworkers (65) found that unadjusted and risk-adjusted mortality rates in Massachusetts, a state without public reporting, decreased at a similar rate to those in New York, which calls into question the effectiveness of publicly releasing performance data. In contrast, Peterson and associates (66) reported a greater decrease in 30-day adjusted and unadjusted CABG mortality rates among elderly patients in New York compared with the national trend (33% vs. 19%). Moscucci and colleagues (67) reported a lower unadjusted mortality rate in New York than in Michigan, a state without a public reporting system for cardiac data, and found no statistically significant difference in adjusted mortality rates.

Four studies investigated unintended consequences of the NYS CSRS and New York State percutaneous coronary intervention (PCI) reports. Omoigui and colleagues (68) found that the expected and observed mortality rate of New York residents who underwent CABG surgery at the Cleveland Clinic increased after the 1991 release of the CSRS, suggesting selective referral out of state of sicker cardiac patients. However, Peterson and associates (66) found no evidence that the program decreased access to cardiac surgery among elderly patients in New York with acute myocardial infarction or among higher-risk elderly subsets. Dranove and colleagues (69) showed that teaching hospitals in Pennsylvania and New York picked up an increasing share of severely ill patients requiring CABG compared with states without public reporting systems, although illness severity was based on hospital expenditures and hospital days rather than direct clinical measures. Moscucci and colleagues (67) found that higher-risk patients in New York were less likely to receive PCI than were those in Michigan, which does not have PCI public reporting. The authors suggested that the statistically significant case-mix difference indicates a propensity in New York toward not intervening in higher-risk patients and speculated that fear of public reporting is the cause of case selection bias.

Four of the 11 studies focused on the CHQC Program. Rosenthal and associates (70) reported a decrease in the risk-adjusted in-hospital mortality rate for most conditions that was associated with the CHQC Program, but they did not compare risk-adjusted mortality rates with those in regions that lack public reporting programs. Clough and coworkers (71) compared risk-adjusted in-hospital mortality rate trends in Cleveland hospitals with those in the rest of Ohio (where no public reporting programs were implemented) and showed that the rate of decline of in-hospital mortality in both sets of hospitals was statisti-

Figure 2. **Study flow diagram.**



cally indistinguishable. In a subsequent study of the same program, Baker and colleagues (72) showed that increases in mortality after hospital discharge tended to offset the decreases in in-hospital mortality such that no net reduction in 30-day mortality resulted. In another study, Baker and colleagues (53) found that risk-adjusted 30-day mortality rates at high-mortality outlier hospitals did not statistically significantly decrease after release of the reports.

Longo and associates (60) found that a hospital-level obstetrics reporting program in Missouri improved several measures, including rates of very low birthweight infants. In a controlled before–after trial, Hibbard and coworkers (55) compared patient safety measures in hospitals participating in the public data-reporting QualityCounts program with those in hospitals receiving confidential feedback or no feedback. Among hospitals with low baseline obstetric performance, public reporting was associated with better performance compared with the 2 other groups.

Individual Providers

Selection

We identified 7 articles on the impact of public release of performance data on consumers' choice of individual providers (4 of which were published since 1999). Five studies suggest that the NYS CSRS affected selection of individual providers. In a study that used multivariable conditional logit models, Mukamel and colleagues (73) found that New York Medicare enrollees were less likely to select a surgeon with higher published mortality rates. In another study that did not adjust for confounders, Mukamel and Mushlin (49) found that physicians with better outcomes had higher growth rates in their charges for CABG. In contrast, Hannan and associates (50) did not find a change in individual providers' unadjusted volume of surgery. Subsequently, Hannan and associates (74) found that the decrease in risk-adjusted mortality was not due to shifts from low-volume to high-volume surgeons; rather, the low-volume surgeons stopped practicing and surgeons who were either new to the system or had inconsistently low volume performed better. Using multivariable logistic regression, Jha and Epstein (52) reported that the odds of ceasing practice was statistically higher (odds ratio, 3.5 [CI, 1.35 to 9.01]) for surgeons performing in the bottom quartile.

Two studies on the impact of public reporting of performance data on intermediaries' selection (contracting) practices provide mixed results. Mukamel and colleagues (75) found that only 20% of managed care organizations indicated that the NYS CSRS reports were a major factor in their contracting decisions. Cross-sectional analyses of actual contracting patterns show that in the aggregate, no systematic selection either for or against surgeons on the basis of their reported mortality scores occurred. In another study of managed care organizations–cardiac surgeon contracting patterns, Mukamel and colleagues (76) found that New York cardiac surgeons with higher reported quality were more likely to have a managed care organization contract; however, this occurred only in certain parts of the state.

Quality Improvement Activity

We identified no published studies of the effect of publicly reporting performance data on quality improvement activity among physicians or physician groups.

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In a study of the effect of the NYS CSRS, Hannan and associates (50) found that risk-adjusted mortality rates for surgeons, who were classified into terciles on the basis of risk-adjusted in-hospital mortality, decreased for all terciles after the data were released.

Six studies focused on whether public reporting causes unintended consequences (4 of which were published in or after 1999). Four articles assessed whether publicly reporting performance data negatively affects access to care for more severely ill patients. Three of these articles were descriptive. For example, Schneider and Epstein (77) found reluctance among Pennsylvania cardiac surgeons to operate on high-risk patients and difficulty among Pennsylvania cardiologists in finding a surgeon for high-risk cardiac patients after the implementation of public reporting. Burack and coworkers (78) reported similar findings after surveying New York cardiac surgeons, as did Narins and associates (79), who performed a cross-sectional survey of interventional cardiologists after implementation of the New York PCI program. However, Hannan and colleagues (74)

found that, in comparing observed and expected patient mortality rates among low-volume New York surgeons, the decrease in risk-adjusted mortality rate was not explained by changes in patient case mix.

Two articles examined the impact on access to care for certain socioeconomic groups. In Werner and colleagues' retrospective cohort study (80), New York had greater disparity than other states among racial groups in the use of CABG (adjusted for sociodemographic characteristics and severity of illness) after the NYS CSRS was implemented. These disparities decreased over time. Mukamel and associates (73) found that after the NYS CSRS was implemented, persons from higher socioeconomic neighborhoods were more likely to be treated by surgeons with low risk-adjusted mortality rates, whereas persons in lower socioeconomic neighborhoods were more likely to be treated by surgeons with higher risk-adjusted mortality rates.

Discussion

In our review of the currently available peer-reviewed evidence on public reporting as a mechanism for improving quality, we identified 27 new articles published since 1999. We conclude that studies of the effect of public reporting on outcomes provide mixed signals, and the usefulness of public reporting in improving patient safety and patient-centeredness remains unknown because few studies assessed these end points. These studies, which were mostly hospital-level and had medium global ratings, focused primarily on mortality rates and cardiac procedures. We found additional support for the conclusion that public reporting stimulates hospital quality improvement activity, although studies were mostly descriptive in nature and had low global ratings. New since 2000 are studies of the impact of public reporting on consumer selection of health plans. These studies, which used more rigorous methods and had higher global ratings, provide mixed evidence for an effect on this pathway. Several studies, which received a range of global ratings, found unintended consequences, such as a reluctance to care for high-risk patients after the NYS CSRS data were released. Finally, the lack of published empirical data that Marshall and associates (27) noted in 2000 still persists.

Despite a decade of new public reporting systems, many studies still focused on the same systems analyzed by Marshall and associates (27), particularly the NYS CSRS. The effects of major reporting systems, such as HealthGrades (81) and HealthScope (82), on effectiveness, patient safety, and patient-centeredness have not been published in the peer-reviewed literature. Notably absent are studies that compare and contrast different reporting systems. One bright spot is that several studies reported on the effects of public reporting systems that include measures in CAHPS and the Health Employer Data and Information Set.

How can we explain the contrast between our results and the interest and resources that are being directed toward public reporting (12, 20–22, 83)? Despite its theoretical appeal, making public reporting work requires successfully addressing several challenges, most notably designing and implementing a reporting system appropriate for its purpose. We suspect that "upstream" design and implementation issues affected "downstream" selection and quality improvement pathways and end points (effectiveness, patient safety, and patient-centeredness). Evidence suggests that poorly constructed report cards may impair consumers' comprehension of these measures and may cause consumers to make decisions that are inconsistent with their goals (84). Earlier studies suggested that consumers (and their intermediaries) were not seeking out this information (27, 77, 85–88), although recent pay-for-performance initiatives have increased use of performance data among purchasers (89–91). It is possible that design and implementation issues, if sufficiently improved, could increase the impact of publicly reported performance data on effectiveness, patient safety, and patient-centered care.

Our review has limitations. We did not include gray or trade literature (for example, a National Committee for Quality Assurance report [92] that describes improvements in quality associated with public reporting). Improvements in report card design and implementation (such as development of Web-based report cards and increased distribution of report cards through the Internet) may limit the generalizability of older studies to current public reporting systems.

Numerous public reporting systems (26, 81, 93, 94) create ample opportunities for research to fill our knowledge gaps. Future research should focus on 3 lines of work. First, additional data points are needed. More existing reporting systems should be evaluated in studies using rigorous designs with a plausible comparison strategy, so that secular trends and bias from the intervention effect can be distinguished. Second, research is needed on the effect of report design and implementation on the report's impact. Finally, studies should examine empirically the causal pathways through which public reporting influences quality of care. If the past 7 years are any indication of what the next 7 years will look like, we can expect more studies about the same few reporting systems and little evaluation of many of the prominent public reporting systems unless better coordinated funding and research strategies are implemented.

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Appendix Table 1. Search Strategies†

PubMed, 1999–2006
Other limiters: English, human
Search 1
Title search on Marshall et al. (27)
Items retrieved: 31
Search 2
"Related articles" search on Marshall et al. (27)
Items retrieved: 312
Search 3
"Related articles" search on Schneider and Lieberman (29)
Items retrieved: 49
Search 4A
information dissemination OR information services OR disclos* OR data shar* OR report card* OR profil* OR disseminat*[tiab]
AND
public opinion OR attitude of health personnel OR consumer participation OR benchmark* OR consumer*[tiab] OR public[tiab]
AND
quality of health care[mj] OR hospitals/standards[mh:noexp] OR physicians/standards[mh:noexp] OR performance[tiab]
Items retrieved: 1691
Search 4B: The following terms were added to search 4A:
public opinion OR attitude of health personnel OR consumer participation OR benchmark* OR consumer*[tiab] OR public[tiab]
AND
quality of health care[mj] OR hospitals/standards[mh:noexp] OR physicians/standards[mh:noexp] OR performance[tiab]
AND
transparen* OR scorecard* OR score card*
NOT
Results of search 4A
Items retrieved: 67

EconLit, 1999–2006
Search 5A*
kw: health* or kw: medical or kw: doctor* or kw: physician* or kw: nurs*
AND
kw: report* or kw: scorecard* or kw: profil* or kw: benchmark* or kw: inform*
AND
kw: public* or kw: disclos* or kw: disseminat* or kw: releas* or kw: publish* or kw: share* or kw: sharing)
AND
kw: quality or kw: standard+
Items retrieved: 358
Search 5B
kw: health* or kw: medical or kw: doctor* or kw: physician* or kw: nurs*
AND
de: information
AND
de: quality or de: standard
NOT
Results of search 5A
Items retrieved: 26

Wilson Business Periodicals Abstracts, 1999–2006
Search strategies*
kw: health* or kw: medical or kw: doctor* or kw: physician* or kw: nurs*
AND
kw: report* or kw: scorecard* or kw: profil* or kw: benchmark* or kw: inform*
AND
kw: public* or kw: disclos* or kw: disseminat* or kw: releas* or kw: publish* or kw: share* or kw: sharing
AND
de: quality or de: standard+ or de: ranking or de: rating
Items retrieved: 200

† "kw" indicates a keyword or terms from title, abstract or subject heading; "de" indicates a descriptor (subject heading term).

Appendix Table 2. **Effect of Public Release of Performance Data on Hospital Quality***

Study, Year (Reference)	Objective	Domain 1: Sample		
Selection		**Subject of Public Reporting**	**Participants**	**Rating†**
Mennemeyer et al., 1997 (47)	To assess the relationship between the release of HCFA hospital-specific mortality rates and utilization (discharges); to compare the impact of publicly releasing HCFA mortality rates to press reports of unexpected deaths, on utilization	U.S. hospitals providing care to Medicare patients	Community hospitals treating Medicare patients (1984–1992)	★★★★
Vladeck et al., 1988 (48)	To examine the relationship between mortality rate outlier status and hospital CABG volume after HCFA release of hospital mortality rates	New York hospitals providing care to Medicare patients	All New York general acute hospitals serving Medicare patients (~1985 to ~1986)	★★★★
Mukamel and Mushlin, 1998 (49)	To measure the relationship between provider ratings in the NYS CSRS and rates of growth in fee-for-service market share	All New York hospitals performing CABG	All New York hospitals performing CABG (1990–1993)	★★★
Hannan et al., 1994 (50)	To determine whether mortality rate outlier status was associated with overall improvement in risk-adjusted mortality and changes in provider volume of CABGs performed after NYS CSRS implementation	All New York hospitals performing CABG	All New York hospitals performing CABG (1989–1992)	★★★★
Chassin, 2002 (51)	To examine the relationship between mortality rate outlier status and hospital CABG volume and quality improvement activity after NYS CSRS implementation	All New York hospitals performing CABG	New York hospitals with the highest and lowest CABG mortality (1989–1995)	★★★★
Jha and Epstein, 2006 (52)	To examine the relationship between providers' NYS CSRS rankings and market share; to examine impact of cardiac surgeons' performance on the likelihood of ceasing practice in New York	All New York hospitals performing CABG	All New York hospitals performing CABG for >3 years (1989–2002)	★★★★
Baker et al., 2003 (53)	To examine market share after release of risk-adjusted 30-day mortality rates for 6 acute conditions as part of the CHQC program	30 nonfederal hospitals in northeast Ohio	30 nonfederal hospitals (1991–1997)	★★★
Romano and Zhou, 2004 (54)	To examine the relationship between outlier status in California and New York public reports for 3 conditions or procedures (CABG mortality in New York; AMI and postdiskectomy complications in California) and hospital volume	All New York hospitals performing CABG; all nonfederal California hospitals	All licensed, nonfederal hospitals in New York performing CABG, and nonfederal hospitals in California except Kaiser hospitals and state developmental and correctional hospitals	★★★★
Hibbard et al., 2005 (55)	To compare the impact of public (QualityCounts), internal (confidential), and no reporting on quality improvement activity, market share (hospital discharges), and risk-adjusted performance (2 summary indices of adverse events and indices in 3 clinical areas—hip/knee surgery, cardiac care, and obstetric care)	24 hospitals in south-central Wisconsin	Hospitals participating in QualityCounts	★★
Quality improvement				
Chassin, 2002 (51)	To examine the relationship between mortality rate outlier status and hospital CABG volume/quality improvement activity following the implementation of the NYS CSRS	All New York hospitals performing CABG	Key informants at 4 hospitals and state officials directly involved in quality improvement efforts at the hospitals (interviewed in 2001)	★★
Dziuban et al., 1994 (56)	To document a hospital's response to being identified as a high risk-adjusted mortality outlier in the NYS CSRS	All New York hospitals providing CABG surgery	1 outlier hospital (1992–1993)	★★
Bentley and Nash, 1998 (57)	To determine whether Pennsylvania Health Care Cost Containment Council's Consumer Guide to CABG, which compared in-hospital mortality rates, led to more changes in Pennsylvania hospitals' CABG policies/practices than in New Jersey hospitals, which were not required to publicly report performance results	Hospitals providing CABG surgery in Pennsylvania	Key informants at hospitals identified by the chief executive officers of 21 Pennsylvania and 8 New Jersey hospitals (1995–1996)	★★★

Appendix Table 2—**Continued (*top*)**

Domain 2: Design		Key Findings	Global Rating§
Type	**Rating‡**		
Observational cohort	★★★	Hospitals with mortality rates twice that expected by HCFA had <1 fewer discharge per week in the first year; press reports of single, unexpected deaths were associated with 9% decrease in hospital discharges within 1 year	√√
Analysis of time trend	★★	No statistically significant effect on occupancy rates	√
Observational cohort	★★	Hospitals with better outcomes experienced higher rates of growth in market share	√
Observational cohort	★★★	No association overall between mortality rate outlier status and hospital volume	√√
Analysis of time trend	★★	Small changes in market share and less than half the time in the expected direction	√
Time series	★★★	No relationship between ranking and subsequent market share	√√
Time series	★★★	No relationship overall between higher-than-expected mortality rates and market share	√√
Time series	★★★	No statistically significant AMI-related volume changes among outlier hospitals; slight increase in lumbar diskectomy–related volume for low-complication outliers; transient increase in CABG volume for low-mortality hospitals and transient decrease in volume for high-mortality outliers	√√
Analysis of time trend	★★	No changes in market share for hospital with publicly reported data; no results given for internal or no reporting groups	√
Case series	★	Increase in quality improvement activity (e.g., staffing policy changes, multidisciplinary approach to examining care processes, changes in operating room schedule)	√
Case study	★	Quality improvement activity increased (change in timing and technique used for patients undergoing emergent CABG, change in hospital policies)	√
Survey (descriptive)	★	Response in Pennsylvania hospitals (e.g., recruited staff, started continuous quality improvement program to improve CABG procedures); more changes in Pennsylvania than New Jersey hospitals (no formal statistical testing because the sample was small)	√

Continued on following page

Appendix Table 2—**Continued (*middle*)**

Study, Year (Reference)	Objective	Domain 1: Sample		
Selection		**Subject of Public Reporting**	**Participants**	**Rating†**
Hibbard et al., 2003 (31)	To compare the effects of public (QualityCounts), confidential, and no reporting on quality improvement activity, market share, and risk-adjusted performance (2 summary indices of adverse events and indices in 3 clinical areas—hip/knee surgery, cardiac care, and obstetric care)	24 hospitals in south-central Wisconsin	Hospitals participating in QualityCounts (2002)	★★
Hibbard et al., 2005 (55)	To compare the effects of public (QualityCounts), internal (confidential), and no reporting on quality improvement activity, market share (hospital discharges), and risk-adjusted performance (2 summary indices of adverse events and indices in 3 clinical areas—hip/knee surgery, cardiac care, and obstetric care)	24 hospitals in south-central Wisconsin	Hospitals participating in QualityCounts	★★
Rosenthal et al., 1998 (58)	To measure quality improvement activity following release of CHQC reports of mortality rates, length of stay, and cesarean section rates (all measures adjusted for severity)	Cleveland hospitals	1 academic and 3 community hospitals of varying size	★★
Tu and Cameron, 2003 (59)	To study the impact of the "Cardiovascular Health and Services in Ontario: An ICES Atlas," which reports hospital-specific AMI performance measures, on quality improvement activity	All Ontario hospitals providing AMI care	Physicians working in Ontario hospitals representing 62 of 121 eligible hospitals (52% overall hospital response rate) (2000)	★★
Longo et al., 1997 (60)	To examine the impact of Missouri Department of Health's obstetrics consumer report, which provides structure, process, and outcomes measures, on quality improvement activity and clinical outcomes	All Missouri hospitals providing obstetric care	Key informants designated by hospital administrators at 82 hospitals (93% response rate) (1994)	★★★
Luce et al., 1996 (61)	To describe quality improvement activity after California CHOP report featuring risk-adjusted outcomes	All California nonfederal hospitals	17 of 22 public hospitals that are members of the California Association of Public Hospitals and Health Systems (1993–1994)	★★
Rainwater et al., 1998 (62)	To describe the impact of publicly reporting California's CHOP risk-adjusted 30-day inpatient mortality rates for patients with AMI on quality improvement activity	California nonfederal acute-care hospitals	39 key informants at a sample of acute-care hospitals in California (1996–1997)	★★
Mannion et al., 2005 (63)	To describe impact of the NHS star performance ratings on quality improvement efforts	All hospital trusts in England	Staff at 4 low-performing hospital trusts and 2 high-performing hospital trusts	★★
Clinical outcome				
Hannan et al., 1994 (64)	To assess changes in in-hospital mortality rates of CABG patients after publication of mortality data in the NYS CSRS	All New York hospitals performing CABG	57 187 patients undergoing CABG (1989–1992)	★★★★
Dziuban et al., 1994 (56)	To document a hospital's response to being identified as a high risk-adjusted mortality outlier in the NYS CSRS	All New York hospitals performing CABG	One poor-performing New York hospital (1992–1993)	★★
Hannan et al., 1994 (50)	To determine whether mortality rate outlier status was associated with changes in CABG-related in-hospital RAMRs and changes in provider volume of CABG performed after NYS CSRS implementation	All New York hospitals performing CABG	All New York patients discharged after CABG (1989–1992)	★★★★
Peterson et al., 1998 (66)	To examine the impact of the NYS CSRS on in-hospital mortality rates by comparing mortality rates in New York to those in other states	All New York hospitals performing CABG	Medicare patients ≥65 years of age who underwent CABG in a U.S. hospital (1987–1992)	★★★★
Ghali et al., 1997 (65)	To compare trends in CABG-related mortality in Massachusetts (which lacks statewide public reporting of CABG outcomes) with those in New York (which has public reporting) and northern New England	All New York hospitals performing CABG	12 Massachusetts hospitals performing cardiac surgery (except Veterans Affairs hospitals) and hospitals contained in the HCFA hospital 30-day unadjusted mortality data set (1990, 1992, and 1994)	★★★★

Appendix Table 2—**Continued (*middle*)**

Domain 2: Design		Key Findings	Global Rating§
Type	**Rating‡**		
Controlled trial	★★★	QualityCounts hospitals did not engage in different strategies of quality improvement overall, but they did engage in a statistically higher number of quality improvement efforts specific to the areas included in the reports	√
Descriptive (survey)	★	Of 7 possible activities, the mean number of quality improvement activities was 4.1 overall (5.7 for hospitals with improved ratings and 2.6 with no change in ratings); 4 had a decrease in ratings; no formal statistical testing	√
Case series	★	Quality improvement activities increased (e.g., interdisciplinary process improvement teams, review of processes of care, development of practice guidelines)	√
Descriptive (survey)	★	54% of respondents indicated that their hospitals made ≥1 change in response to public reporting	√
Descriptive (survey)	★	Hospitals instituted services (e.g., hospital policy that infants ride in car seats upon discharge, formal neonatal transfer agreements) after the reports were published	√
Descriptive (survey)	★	Minimal impact on quality improvement activity	√
Interviews	★	Minimal impact on quality improvement activity (two thirds of respondents indicated no specific activity)	√
Case series	★	Ratings transmitted important priorities from central government and helped direct and concentrate front-line resources	√
Observational cohort	★★★	RAMR decreased from 4.17% to 2.45%	√√
Case study	★	Excess mortality was localized to high-acuity patients undergoing emergent CABG; mortality decreased to 0% over 1 year after a focused effort to optimize management of these patients	√
Observational cohort	★★★	Reductions in RAMR, especially among hospitals that had highest initial mortality rates; convergence in risk-adjusted mortality rates among hospitals initially identified as high, medium, and low performers	√√
Observational cohort	★★★	Both unadjusted and risk-adjusted mortality rates in New York decreased more than in other states	√√√
Observational cohort	★★★	RAMR reductions in Massachusetts were similar to mortality reduction in New York and northern New England; unadjusted mortality trends were similar in Massachusetts, New York, northern New England, and the United States	√√

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Appendix Table 2—**Continued (*end*)**

Study, Year (Reference)	Objective	Domain 1: Sample		
Selection		**Subject of Public Reporting**	**Participants**	**Rating†**
Rosenthal et al., 1997 (70)	To measure changes in hospital mortality that occurred after implementation of the CHQC reporting initiative, which publicly released in-hospital mortality rates	Cleveland hospitals	101 060 consecutive eligible discharges with 8 diagnoses from 30 northeastern Ohio hospitals (1991–1993)‖	★★★
Baker et al., 2003 (53)	To examine hospitals' market share and 30-day risk-adjusted mortality at hospitals participating in CHQC	Hospitals in the Cleveland area	Medicare patients receiving care at Cleveland-area hospitals (1991–1997)	★★★
Clough et al., 2002 (71)	To measure changes in in-hospital mortality rates associated with the implementation of the CHQC reporting initiative	Cleveland hospitals	Hospitals included in the Ohio Hospital Association's inpatient discharge data (1992–1995)	★★★
Longo et al., 1997 (60)	To examine the impact of Missouri Department of Health's obstetrics consumer report, which provides structure, process, and outcomes measures	All Missouri hospitals providing obstetric care	All Missouri hospitals providing obstetrics care (1989–1994)	★★★
Hibbard et al., 2005 (55)	To compare the impact of public (Quality-Counts), confidential, and no reporting on quality improvement activity, market share, and risk-adjusted performance (2 summary indices of adverse events and indices in 3 clinical areas—hip/knee surgery, cardiac care, and obstetric care)	24 Wisconsin hospitals	115 Wisconsin hospitals (2001–2003)	★★
Moscucci et al., 2005 (67)	To measure the effect of the New York State PCI report on case selection for PCI by comparing Michigan's and New York's adjusted and unadjusted in-hospital mortality rates	All New York hospitals performing CABG	11 374 patients in a multicenter Michigan PCI database and 69 048 patients in a statewide New York PCI database (1998–1999)	★★★★
Unintended consequences				
Omoigui et al., 1996 (68)	To determine whether dissemination of NYS CSRS mortality data was associated with outmigration of high-risk patients to undergo treatment at the Cleveland Clinic	All hospitals performing CABG in New York	9442 patients receiving CABG at the Cleveland Clinic (1989–1993)	★★★★
Peterson et al., 1998 (66)	To examine the impact of the NYS CSRS on in-state access to CABG and referral out of state of patients in need of CABG	All New York hospitals performing CABG	Medicare patients ≥65 years of age who underwent CABG in a U.S. hospital (1987–1992)	★★★★
Dranove et al., 2003 (69)	To study the effects of public reporting in New York and Pennsylvania	All New York and Pennsylvania hospitals performing CABG	Medicare beneficiaries and hospitals found in a Medicare claims data set (not specified) and hospitals participating in the American Hospital Association annual survey (1987–1994)	★★★★
Baker et al., 2002 (72)	To examine mortality trends associated with the CHQC program	Cleveland hospitals	Medicare patients hospitalized with AMI, heart failure, gastrointestinal hemorrhage, obstructive pulmonary disease, pneumonia, or stroke (1991–1997)	★★★
Mannion et al., 2005 (63)	To describe impact of the NHS star performance ratings on quality improvement efforts	All hospital trusts in England	Staff at 4 low-performing hospital trusts and 2 high-performing hospital trusts	★★
Moscucci et al., 2005 (67)	To measure the effect of the NYS CSRS on case selection for PCI by comparing Michigan's and New York's adjusted and unadjusted in-hospital mortality rates	All New York hospitals performing CABG	11 374 patients in a multicenter (8-hospital) PCI database in Michigan and 69 048 patients in a statewide (34-hospital) PCI database in New York (1998–1999)	★★★★

* AMI = acute myocardial infarction; CABG = coronary artery bypass graft; CHOP = California Hospital Outcomes Project; CHQC = Cleveland Health Quality Choice; HCFA = Health Care Financing Administration (now the Centers for Medicare & Medicaid Services); ICES = Institute for Clinical Evaluative Sciences (Toronto); NHS = National Health Service; NYS CSRS = New York State Cardiac Surgery Reporting System; PCI = percutaneous coronary intervention; RAMR = risk-adjusted mortality rate.

† Samples with 4 stars were representative of the population in whom public reporting is contemplated; those with 3 stars had major overlap between the targeted sample and the population in whom public reporting is contemplated; those with 2 stars had a narrow set of characteristics that differs from that of the population in whom public reporting is contemplated; and those with 1 star were completely different from the population in whom public reporting is contemplated.

‡ 4 stars indicate a randomized trial or experimental study; 3 stars indicate a controlled trial, pre–post trial with control (controlled before–after trial), time series, or observation cohort with multivariable adjustment; 2 stars indicate a pre–post trial without control, observational cohort study without multivariable adjustment, cross-sectional study without multivariable adjustment, analysis of time trends without control, or well-designed qualitative study; and 1 star indicates a case series, other qualitative study, or survey (descriptive) study.

§ 3 checks indicate great weight in the stratum's body of evidence, 2 checks indicate moderate weight, and 1 check indicates little weight.

‖ 8 diagnoses were AMI, heart failure, obstructive airway disease, gastrointestinal hemorrhage, pneumonia, stroke, CABG, and lower bowel resection.

Appendix Table 2—**Continued (*end*)**

Domain 2: Design		Key Findings	Global Rating§
Type	**Rating‡**		
Time series	★★★	Risk-adjusted mortality for most conditions declined from 7.5% to 6.8% (July–December 1992), 6.8% (January–June 1993), and 6.5% (July–December 1993) for 3 periods after publication; decreases in mortality rates were statistically significant in weighted linear regression analyses for heart failure (0.50% per period) and pneumonia (0.38% per period)	√
Time series	★★★	Hospital outlier status was not related to changes in risk-adjusted 30-day mortality overall	√√
Observational cohort	★★★	No statistical difference in rate of decline in combined mortality in Cleveland compared with the rest of the Ohio	√√
Observational cohort	★★★	Outlier hospitals had improvements in rates of ultrasonography, vaginal birth after cesarean section, and cesarean section	√√
Controlled before–after trial	★★★	Performance feedback, whether public or confidential, was associated with improved performance	√√
Observational cohort	★★★	Unadjusted mortality rates were lower in New York than Michigan, but adjusted mortality rates were not statistically different	√√
Observational cohort	★★★	Patients from New York receiving CABG at the Cleveland Clinic had higher expected mortality than the New York statewide mix, patients from Ohio, and patients from other states or countries	√√
Observational cohort	★★★	New York patients with AMI were less likely to receive CABG than those admitted outside New York, but the overall percentage increased, paralleling national trends, even among higher risk elderly subsets; out-of-state CABG rates decreased	√√√
Observational cohort	★★★	Report cards were associated with a shift in CABG use to healthier patients, leading to worse cardiac outcomes, especially among sicker patients (who were defined as higher hospital expenditures and days in hospital)	√√
Time series	★★★	Risk-adjusted in-hospital mortality declined for most conditions, but mortality rate in the early postdischarge period rose for most conditions and the 30-day mortality rate declined for only heart failure and obstructive pulmonary disease and increased for stroke	√√
Case series	★	Public reporting led to tunnel vision, distortion of clinical priorities, and disincentive to improve performance among high-rated organizations	√
Observational cohort	★★★	Significant case-mix differences between patients undergoing PCI in Michigan and New York, suggesting a propensity in New York toward not intervening on high-risk patients	√