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Public Reporting of Cardiac Outcomes for Patients With Acute Myocardial Infarction : A Systematic Review of the Evidence

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Abstract

Background—Percutaneous coronary intervention (PCI) is recognized by both the American Heart Association and the American College of Cardiology as an optimal therapy to treat patients experiencing acute myocardial infarction (AMI) with ST-segment elevation myocardial infarction. A health policy aimed at improving outcomes for the patient with AMI is public reporting of whether a patient received a PCI.

Objective—A systematic review was conducted to evaluate the effect of public reporting for patients with AMI, specifically for those patients who receive PCI.

Methods—EMBASE, MEDLINE, Academic Search Premier, Google Scholar, and PubMed were searched from inception through August 2017. Articles were selected for inclusion if researchers evaluated public reporting and included an outcome for whether a patient received a PCI during hospitalization for an AMI. Methodological quality of the included studies was evaluated, and findings were synthesized.

Results—Eight studies of high methodological quality were included in the review. Most studies found that, in areas of public reporting, patients were less likely to undergo a PCI and high-risk patients did not undergo a PCI. Researchers also found that patients with AMI had lower in-hospital mortality after the implementation of public reporting, but only if these patients received a PCI.

Conclusions—Although public reporting may have had intentions of improving care, there is strong evidence that this policy did not result in more timely PCIs or improved mortality of

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patients with AMI. In fact, public reporting resulted in unintended consequences of not providing care for the most vulnerable patients in fear of an adverse outcome.

Keywords

myocardial infarction; percutaneous coronary intervention

According to the American Heart Association, an acute myocardial infarction (AMI) occurs approximately every 40 seconds affecting more than 750 000 Americans annually.¹ It is the fifth most expensive condition treated in US hospitals accounting for approximately one-fifth of the total aggregate costs for all hospitalizations.¹⁻³ Extensive strides have been made in treatment for the patient with AMI, which include interventions such as thrombolytics and percutaneous coronary intervention (PCI). These forms of treatment are recognized by both the American Heart Association and the American College of Cardiology as optimal therapies to treat patients with AMI, especially those with ST-segment elevation myocardial infarction.¹ Timely reperfusion of the coronary arteries by balloon inflation within 90 minutes of arrival⁴ has been linked to improved outcomes including a high percentage of lasting reperfusions, lower rates of complications, decreased hospital length of stay, and cost.⁵ With approximately 1 000 000 PCIs performed annually,⁶ timely reperfusion is a necessary intervention as the mortality rate increases by 7.5% for every 30-minute delay beyond the 90-minute window from the time of arrival to the hospital to balloon inflation in the cardiac catheterization department.^{7,8}

To encourage providers to meet the 90-minute window for patients with AMI, public reporting of AMI outcomes was implemented in some states as a policy to improve cardiac care. Public reporting began when providers and hospitals were required to disclose coronary artery bypass graft (CABG) surgery data in the Society of Thoracic Surgeons Adult Cardiac Surgery Database.^{9,10} Pennsylvania became the first state in 1986 to implement public reporting, followed by New York in 1989.⁹ The implementation of public reporting in New York was accompanied by a 41% decline in the CABG mortality rate.¹¹ However, similar declines in mortality have been observed in neighboring states without public reporting legislation in place.⁷ Conversely, public reporting in New York may have resulted in risk-averse behaviors demonstrated in CABG surgery causing the sicker patients to be excluded from necessary care and consequently seeking treatment elsewhere.^{12,13}

Over the last 20 years, Massachusetts, New Jersey, and Washington implemented public reporting legislation mandating providers to report whether a patient with AMI receives timely reperfusion therapy through a PCI within a 90-minute window. Therefore, only 4 states in the United States mandate this process for the population with AMI. In addition to state legislation, the National Cardiovascular Data Registry Cath/PCI registry, which also collects PCI data supported by the American College of Cardiology, represents approximately 2400 hospitals; however, hospital participation in public reporting of their National Cardiovascular Data Registry data is voluntary and only available at the hospital level.¹⁴

Proponents of public reporting for AMI outcomes aim to improve care by holding providers and organizations accountable for receiving a PCI, resulting in better clinical outcomes for patients with AMI.⁶ Therefore, examining the evidence on whether public reporting improves outcomes for patients with AMI, who may or may not have undergone an intervention such as PCI, is needed and timely. This systematic review examines studies that evaluate the outcomes of public reporting for patients with AMI, specifically for those who received a PCI. To conduct the review systematically, the following Population-Intervention-Comparison-Outcome question was asked: “In patients with an AMI, what is the effect of the presence of public reporting legislation on whether or not a patient receives a PCI?”

Methods

Search Strategy

Wolters Kluwer’s Ovid (EMBASE and MEDLINE), Academic Search Premier, Google Scholar, and PubMed were searched from 1995 through August 2017. This decision was deliberate because public reporting legislation was implemented in 1995.⁹ The Cochrane Database of Systematic Reviews and the Joanna Briggs Institute Database of Systematic Reviews and Implementations Reports were searched to ensure that no existing systematic reviews have been published. The following search terms were used in combination with “public reporting”: “cardiac outcomes,” “myocardial infarction,” “coronary artery bypass graft,” “quality patient care,” and “percutaneous coronary intervention.” The inclusion criteria for studies were ones that were written in English, used a quantitative design, and were published in a peer-reviewed journal. In addition, each study examined the outcome for whether a patient received a PCI during hospitalization for an AMI. Other clinical outcomes included CABG, cardiogenic shock, tamponade, and mortality. The titles, abstracts, and reference lists were screened to identify additional studies. Two authors assessed potential studies, and any disagreements were resolved through a discussion with a third author who provided cardiac care expertise for patients with AMI, which served to clarify the inclusion criteria.

Assessment of Methodological Quality

Methodological quality was assessed using the “Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross Sectional Studies.”¹⁵ This instrument included an 8-question checklist that could be answered by “yes,” “no,” “unclear,” or “not applicable.” A quality threshold score was determined, in which 5 of the 8 questions (62.5%) had to be answered with a “yes” to deem the research of sufficient quality for the review.

Data Extraction

Data were extracted independently using the “Joanna Briggs Institute Data Extraction Form for Experimental/Observational Studies.”¹⁵ This instrument allows researchers to aggregate relevant information from each study by providing questions for researchers to extract data. The following data were extracted: study design, participants, sample size and characteristics, data sources, analysis, outcomes, and results of the study.

Results

Study Selection

A total of 421 studies were identified through systematically searching and examining reference lists of 2 descriptive articles.^{13,16} A Preferred Reporting Items for Systematic Reviews and Meta-Analyses¹⁷ flow diagram outlines the study selection process (Figure 1). After screening, there were 24 full-text articles that met the inclusion criteria and were assessed for eligibility. After excluding 5 studies, 19 studies underwent initial appraisal. After further critique, 9 studies were eliminated and 10 studies were included in the review.

Methodological Quality

All 10 studies were methodologically strong with a range from 6 to 8 questions answerable with a “yes” (Figure 2). Only 2 of the studies were unclear on how they defined their inclusion criteria for the sample.^{18,19} All studies provided a comprehensive description of the study participants, setting, and data sources. The studies also clearly described public reporting and potential confounders, including patient demographics and comorbidities that could contribute to adverse outcomes for patients with AMI. Two research teams did not clearly state that they adjusted for the confounding variables in their analysis.^{19,20} All studies provided clear descriptions of their outcomes and were sufficiently able to measure and analyze these outcomes with appropriate statistical analyses.

Characteristics of Included Studies

Study Designs and Samples—Of the 10 studies included in the review, 9 research teams conducted a secondary data analysis of large datasets^{6,18–25} and only 1 team conducted a randomized clinical trial (Table 1).²⁶ In the randomized clinical trial, 86 hospitals were randomized, but not blinded, to receive either an early or a delayed report for how they performed on 12 AMI process measures.²⁶ Eight studies were conducted in the United States,^{6,18–23,25} 1 study was conducted in Canada,²⁶ and the other was conducted in Italy.²⁴ Sample sizes were large (range, 545–1 340 213 patients) representing several hospitals. The secondary data sets (ie, registries) varied. Two research teams used the same sources, the National Cardiovascular Data CathPCI Registry and the National Inpatient Sample; however, the years of the included sample varied.^{6,18,22,25}

Level of Analysis and Statistical Techniques—All 10 studies conducted patient level analyses and risk-adjusted their statistical models to account for differences in patient severity. In addition, 4 research teams explicitly stated that they accounted for clustering of patients within hospitals,^{6,18,23,25} because failure to account for intrahospital correlation (ie, clustering in which patients in the same hospital may present the same) would exaggerate the number of independent observations and impair the precision of the resulting estimates.²⁷ Three research teams used propensity score matching to address any baseline differences between patients in nonreporting areas compared with reporting areas and used logistic regression to calculate the odds of death.^{18,21,22}

Included Study Results

Percutaneous Coronary Intervention—Among the 10 studies, 5 research teams found that patients in public reporting areas were less likely to receive a PCI compared with patients in reporting areas.^{19,21–23,25} Only 1 research team found that public reporting would increase the proportion of patients treated with PCI.²⁴ Two research teams found some beneficial effects in which public reporting increased the proportion of patients treated with PCI; however, these teams also found that, in areas of public reporting, fewer high-risk patients underwent PCI.^{6,18} The odds of an appropriate PCI was greater in public reporting areas than in non-public reporting areas.¹⁸ Only 2 studies included CABG as an outcome (in addition to PCI^{21,22}) indicative of the change in practice from CABG to PCI as an intervention for patients with AMI.

Mortality—All 10 studies examined patient mortality (ie, in-hospital or 30-day) as an outcome. Two teams found that patients had lower in-hospital mortality after the implementation of public reporting, but only if these patients received a PCI.^{6,18} This was in contrast to 2 teams that found no difference in mortality despite receiving a PCI.^{22,23} In the randomized clinical trial, 30-day mortality rates were 2.5% lower in hospitals that received reporting information earlier.²⁶ One research team found that in-hospital mortality was higher in public reporting areas compared with non-public reporting areas,²⁵ and another team found that public reporting resulted in a decreased risk of mortality for hospitals that accept sicker patients.²⁰ The remaining 3 teams found no significant relationship between public reporting and mortality.^{19,21,24}

Other Clinical Outcomes—Three studies examined other clinical outcomes for the population with AMI.^{6,18,26} One team found that adverse clinical outcomes including having a complication, bleeding, needing a blood transfusion, or contrast-induced nephropathy were lower in a public reporting state compared with a non-public reporting state.¹⁸ Whereas the other team found that public reporting had no significant improvement in the process of care indicators for patients with AMI,²⁶ 1 team examined the association between public reporting and readmissions and found that patients in public reporting states who had a PCI were more likely to be readmitted at 180 days.⁶

Discussion

On the basis of our finding of the systematic review, there is strong, methodological evidence that mandated public reporting does not improve care for patients with AMI. After adjusting for patient severity, there was no significant relationship between public reporting and patient mortality. Two research teams found that mortality was in fact higher in public reporting areas compared with nonreporting areas^{21,25} and can be explained as providers being fearful of conducting an intervention on high-risk patients.²⁰ Additional research also suggests that public reporting may hinder physicians in provide lifesaving care for the most critical patients.²³ Specifically for patients with AMI with ST-segment elevation myocardial infarction, mortality in public reporting states was higher, and once these patients received a PCI, the mortality rate decreased.²⁸ Therefore, avoiding to perform a PCI on a high-risk patient may also result in mortality.

Although evidence in this review does not suggest that public reporting improved care for the patient with AMI, public reporting may have some beneficial outcomes (Table 2). For example, reporting may encourage healthcare providers to keep current with evidence-based guidelines. In a survey of 150 New York state cardiothoracic surgeons, public reporting of information among New York surgeons initiated a dialogue between surgeons and cardiologists, and their patients.²⁹ Although the same research team reported that most (cardiothoracic) surgeons (70%) did not report a change in practice,²⁹ opening the dialogue about treatment options and provider awareness may improve patient care. Furthermore, it may bring attention to providers of the necessary interventions for patients with AMI.

Another possible benefit of public reporting may result from providers being attuned that their clinical outcomes are being recorded. Outcomes for AMI are often measured by real-time clinical data reported by the practitioners and submitted to national databases. The Hawthorne effect, where providers may change behavior when they know they are being “watched,” may ensure that they meet the standard of care. In a study of 5 intensive care units in 1 university hospital, researchers found that, when providers were “watched,” there was a 55% increase in compliance of hand hygiene.³⁰ Therefore, it is plausible that this effect may encourage providers to follow the standard of care for patients with AMI.

A concern with public reporting is the ambivalence and potential additional burden placed on an already stretched healthcare provider. In a recent survey of 228 providers at 7 ambulatory care clinics and 3 public health agencies, researchers found that barriers of publicly reporting included uncertainty about who was responsible for reporting, uncertainty about how reports were used, and lack of clarity about reporting requirements.³¹ Furthermore, providers do not often receive feedback from the reports, which may result in noncompliance to complete reports.

In addition to provider concerns, the value of public reporting remains questionable for the patient as well. Evidence suggests that publicly available information is not used as a determinant in making healthcare decisions.³² Furthermore, patients rarely search for publicly available information and, if they find it, may not understand it, nor trust the data.³² Therefore, public reporting, although initiated to improve transparency of data for patients, may have resulted in adverse outcomes, especially for the sickest patients with AMI.

Practice and Research Implications

To address providers avoiding PCI on high-risk patients, hospital administrators may want to allay fears of penalization from reports. In addition, to support providers in completing reports, state agencies should provide outreach programs to improve provider perceptions regarding the importance of timely and complete clinical data.³¹ Furthermore, current evidence suggests that Yelp ratings are reliable for comparing hospital quality.³³ Therefore, hospital administrators may want to encourage collaborations with official public reporting agencies. For example, in April 2017, the California Health Care Foundation partnered with Yelp to summarize quality measures collected from Hospital Compare and aggregate them alongside the patient and user-generated reviews.³³

To decrease the burden of reporting on providers, research initiatives should focus on investing in systems to streamline public reporting, such as using standardized computer-based platforms. In a survey of providers, respondents spent less time collecting and entering infection data into a computer, as compared with entering them manually.³⁴ Research implications also include integrating public reporting data with clinical data sets. This integration of administrative data with hospital-specific outcome data may provide opportunities for both clinicians and researchers to evaluate quality process measures. For example, there are current initiatives for hospitals to build clinical data warehouses that can provide useful information about patient care to allow providers to slow the progression of a disease.³⁵

Limitations

Although we attempted to be exhaustive in our search, some studies pertaining to public reporting and AMI outcomes may have been missed. As Figure 1 indicates, we first excluded articles by reading titles and abstracts, which may have decreased the number of studies included in the review; however, being cognizant that only 4 states have mandated public reporting legislations in place for patients with AMI, we expected a small sample of studies on this topic. In addition, although we established high interrater agreement and used validated extraction and quality assessment instruments, some scores may have been subject to experience levels of the researchers. Furthermore, the task to synthesize a large amount of evidence and present a smaller subset of conclusions is an additional limitation because all details of each study cannot be presented.

Conclusion

Public reporting is used by local, federal, and state governments, as well as healthcare institutions, to benchmark on performance measures such as quality, safety, and cost in delivering care to the patient with AMI. These policies, despite their questionable value, will most likely continue to exist. Therefore, the challenge is to encourage providers not to fear public reporting and rather support providers in the process, which may ultimately improve care of the patient with AMI.

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What's New and Important

- Legislations requiring public reporting of AMI outcomes were designed to improve patient care; however, this process resulted in unforeseen implications including high-risk patients not receiving timely reperfusion therapy.
- There is no statistically significant relationship between public reporting and decreased mortality. In fact, some evidence suggests that mortality rates are higher in public reporting areas.
- Public reporting has the potential to improve quality because clinicians may become more attuned to the standards of care for the patient with AMI.

FIGURE 1.
Study flowchart.

APPRAISAL QUESTIONS	STUDIES									
	Apolito et. al	Bangalore et. al	Boyden et. al	Cavender et. al	Joynt et. al	McCabe et. al	Moscucci et. al	Renzi et. al	Tu et. al	Waldo et. al
Q1: Were the criteria for inclusion in the sample clearly defined?	●	●	○	●	●	●	○	●	●	●
Q2: Were the study subjects and the setting described in detail?	●	●	●	●	●	●	●	●	●	●
Q3: Was the exposure measured in a valid and reliable way?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●	n/a
Q4: Were objective, standard criteria used for measurement of the condition?	●	●	●	●	●	●	●	●	●	●
Q5: Were confounding factors identified?	●	●	●	●	●	●	●	●	●	●
Q6: Were strategies to deal with confounding factors stated?	●	●	●	●	●	○	○	●	●	●
Q7: Were the outcomes measured in a valid and reliable way?	●	●	●	●	●	●	●	●	●	●
Q8: Was appropriate statistical analysis used?	●	●	●	●	●	●	●	●	●	●

Key	
●	YES
○	NO
n/a	N/A

FIGURE 2.
Methodological quality of included studies.

TABLE 1

Data Synthesis of Studies in the Systematic Review

Author, Publication Year	Design	Sample	Datasets	Outcomes	Results	Did Public Reporting Improve Care?
Apolito et al, ²¹ 2008	Retrospective secondary analysis	<ul style="list-style-type: none"> • 545 patients with AMI and cardiogenic shock due to predominant left ventricular failure • 220 public reporting patients (New York) • 325 non-public reporting patients (non-New York) 	US Shock Registry (36 multinational centers)	<ul style="list-style-type: none"> • PCI • Mortality • CABG 	<ul style="list-style-type: none"> • New York patients with acute MI, 0.46 (95% CI, 0.31–0.68; $P < .001$), and cardiogenic shock, 0.51 (95% CI, 0.33–0.77; $P < .002$), were less likely to undergo a PCI. • The odds of in-hospital mortality was 1.5 times greater for New York than non-New York patients (95% CI, 1.01–2.21; $P = .04$); however, if New York patients had a PCI, there was no significant difference in mortality. 	No
Bangalore et al, ²² 2016	Retrospective secondary analysis	<ul style="list-style-type: none"> • 2126 patients with AMI complicated by cardiogenic shock • 1063 public reporting patients (New York) • 1063 non-public reporting patients (Michigan) 	National inpatient sample	<ul style="list-style-type: none"> • PCI • CABG • In-hospital mortality 	<ul style="list-style-type: none"> • At 3 periods, 2002–2005, 2006–2007, and after 2008, the proportion of patients who underwent PCI was significantly lower in New York than in Michigan. • There was no change in in-hospital mortality of patients with cardiogenic shock who underwent invasive management, PCI, or CABG in New York from public reporting. 	No
Boyden et al, ¹⁸ 2015	Retrospective secondary analysis	<ul style="list-style-type: none"> • 1 055 111 patients who received PCI • 53 528 nonreporting patients (Michigan) • 51 983 public reporting patients (New York) 	The National Cardiovascular Data CathPCI Registry	<ul style="list-style-type: none"> • PCI • Adverse clinical outcomes • In-hospital mortality 	<ul style="list-style-type: none"> • Fewer high-risk patients underwent PCI and had lower in-hospital mortality (0.72) (95% CI, 0.63–0.83; $P < .0001$) in New York compared with other states. • The odds of appropriate PCI was 1.1 times greater for New York patients than Michigan patients. 	Yes
Cavender et al, ⁶ 2015	Retrospective secondary analysis	<ul style="list-style-type: none"> • 1 340 213 patients who received PCI • 155 660 public reporting patients (Massachusetts, New York, and Pennsylvania) • 1 184 544 nonreporting patients (all other nonreporting states) 	The National Cardiovascular Data CathPCI Registry	<ul style="list-style-type: none"> • PCI • In-hospital mortality • Readmissions 	<ul style="list-style-type: none"> • Patients in public reporting states who underwent PCI had lower observed in-hospital mortality, 0.80 (95% CI, 0.74–0.88; $P < .001$). • Hospital readmissions were increased at 180 d, 1.08 (95% CI, 1.03–1.12; $P < .001$). 	Only for patient mortality
Joynt et al, ²³ 2012	Retrospective secondary analysis	<ul style="list-style-type: none"> • 97 702 patients with NSTEMI with a primary diagnosis of subendocardial myocardial infarction, STEMI, cardiogenic shock, or cardiac arrest • 49 660 public reporting patients with AMI (Massachusetts, New York, and Pennsylvania) • 48 142 non-public reporting patients (all other nonreporting states) 	Fee-for-service Medicare Provider Analysis and Review files	<ul style="list-style-type: none"> • PCI • 30-day mortality 	<ul style="list-style-type: none"> • Patients in public reporting states were less likely to receive a PCI compared with patients in nonreporting states, 0.82 (95% CI, 0.71–0.93; $P < .003$). • No significant difference in 30-day mortality between public reporting and non-public reporting. 	No
McCabe et al, ²⁰ 2013	Prevalence study of retrospective data	<ul style="list-style-type: none"> • 116 227 patients who received PCI in Massachusetts 	Massachusetts Data Analysis Center	<ul style="list-style-type: none"> • Change in predicted in-hospital mortality 	<ul style="list-style-type: none"> • Prevalence-weighted mortality rate for PCI was $1.38\% \pm 0.36\%$ • Adjusting for temporal trends, there was an 18% relative reduction in predicted mortality among sickest patients 	No, avoidance of PCI for the sickest patients

Author, Publication Year	Design	Sample	Datasets	Outcomes	Results	Did Public Reporting Improve Care?
Moscucci et al, ¹⁹ 2005	Retrospective secondary analysis	<ul style="list-style-type: none"> 80 422 patients who received PCI 69 048 PCI public reporting patients (New York) 11 374 nonreporting patients (Michigan) 	PCI voluntary registry in Michigan (8 hospitals) and the Coronary Angioplasty Reporting System from the Department of Health registry in New York (34 hospitals)	<ul style="list-style-type: none"> • PCI • Mortality 	<p>hospitals whose risk-adjusted mortality is higher compared with low-risk hospitals.</p> <ul style="list-style-type: none"> • Patients in Michigan more frequently underwent PCI than those patients in New York. • No significant difference in 30-day mortality between public reporting and non-public reporting. 	No
Renzi et al, ²⁴ 2014	Retrospective secondary analysis	<ul style="list-style-type: none"> 641 500 patients with AMI 24 800 AMI public reporting patients (Lazio) 39 350 non-public reporting patients with AMI (nonreporting other regions) 	Hospital information system within the Italian National Health Service	<ul style="list-style-type: none"> • PCI • Mortality 	<ul style="list-style-type: none"> • Public reporting increased the proportion of patients treated with PCI. • No significant difference in 30-day mortality between public reporting and non-public reporting. 	Only for PCI
Tu et al, ²⁶ 2009	Population-based clustered RCT	<ul style="list-style-type: none"> 7746 patients with AMI 4165 patients with AMI in the intervention 3581 patients with AMI in the control 	Canadian Institute for Health Information Discharge Administrative Database (86 hospitals)	<ul style="list-style-type: none"> • Mortality • AMI process of care indicators 	<ul style="list-style-type: none"> • 30-day mortality rates were 2.5% lower (95% CI, 0.1%–4.9%) in hospitals that received public reporting quality information earlier. • AMI process of care indicators for AMI did not significantly improve in the early feedback group. 	Only for patient mortality
Waldo et al, ²⁵ 2015	Retrospective secondary analysis	<ul style="list-style-type: none"> 141 750 patients with AMI 57 629 public reporting patients with AMI (Massachusetts and New York) 84 121 nonreporting patients with AMI (Connecticut, Maine, Maryland, Rhode Island, and Vermont) 	National inpatient sample	<ul style="list-style-type: none"> • PCI • In-hospital mortality 	<ul style="list-style-type: none"> • PCI was performed less often in patients in public reporting states than non-public reporting states, 0.81 (95% CI, 0.67–0.96; $P < .01$). • In-hospital mortality was higher among public reporting states compared with non-public reporting states, 1.21 (95% CI, 1.06–1.37; $P < .001$). 	No

Abbreviations: AMI, acute myocardial infarction; CABG, coronary artery bypass graft; NSTEMI, non-ST-segment elevation myocardial infarction; PCI, percutaneous coronary intervention; RCT, randomized clinical trial.

TABLE 2**Advantages and Disadvantages of Public Reporting**

Consumers	
Benefits	Drawbacks
Encourages consumers to be active in healthcare choices	Data are not always in a useable form
Provides a social good for the informed consumer	Data are not easily accessible
Allows for benchmarking	Data ignore consumer health literacy
Providers	
Benefits	Drawbacks
Holds providers accountable	Data validity is often questioned.
Encourages providers to improve care	Process is burdensome and not valued
Ensures providers to be current on the best evidence	Risk aversion for the sickest patients