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High-Risk Percutaneous Coronary Intervention in Public Reporting States: The Evidence, Shifts in Policy, and Implications

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Abstract

Purpose of Review—Public reporting of outcomes for percutaneous coronary intervention (PCI) is used in some states to drive improvements in care delivery and performance. However, a growing body of evidence suggests unintended consequences, particularly provider aversion to performing PCI in high-risk patients.

Recent Findings—There is mixed evidence regarding the impact of PCI public reporting on patient outcomes. In addition, providers in public reporting states likely have a higher threshold or potentially avoid performing PCI on high-risk patients, such as those with cardiogenic shock. The exclusion of patients with refractory cardiogenic shock from public reports in New York State, has reduced provider risk aversion. Though this represents a step in the right direction, other strategies are needed to diminish continued provider risk aversion and strengthen PCI care quality.

Summary—Public reporting initiatives for PCI are beginning to proliferate nationally. However, the challenge of fostering the positive aspects of reporting, which incentivize improved care quality and procedural performance, while ensuring that high-risk patients continue to receive appropriate care remains. It is imperative that policymakers and cardiologists continue to develop innovative solutions that address risk averse provider behaviors towards high-risk patients.

Keywords

Public reporting; percutaneous coronary intervention; acute myocardial infarction; cardiogenic shock

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Conflict of Interest

Jordan D. Anderson and Robert W. Yeh declare no conflicts of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

Introduction

Public reporting of outcomes for percutaneous coronary intervention (PCI) has been used in some states with the intent of improving care delivery and performance. The impetus to publicly report PCI outcomes stems from the notion that public transparency will motivate providers to further improve quality of care, and consequently outcomes, and that consumers will be provided with information to make informed decisions about where to obtain care. Since the inception of PCI public reports, numerous studies have evaluated their impact on patient care and outcomes. A growing body of evidence suggests unintended consequences, particularly provider aversion to performing PCI in high-risk patients, such as individuals with acute myocardial infarction (AMI) and cardiogenic shock, which is of concern since PCI reporting initiatives are spreading nationally. In this article, we will examine: 1. The prior literature on how public reports have impacted outcomes, 2. The evidence regarding provider aversion to performing PCI in high-risk patients, 3. Why providers may be susceptible to risk-averse behaviors, 4. How shifts in public reporting policy, particularly the exclusion of refractory cardiogenic shock patients from reports, have impacted the care of high-risk patients, and 5. Ongoing challenges and potential future efforts.

The Impact of Public Reporting on Outcomes

The movement to publicly report PCI outcome data began in the state of New York, when in the late 1990's, the New York State Department of Health began to publicly report cardiologists' PCI mortality rates.¹ In the subsequent decades other states, including Massachusetts, Pennsylvania, Texas, and Washington, implemented public reporting programs, though Pennsylvania eventually suspended its initiative. Over time, New York and Massachusetts have reformed their reporting policies for high-risk patients. For example, New York began to exclude patients with refractory cardiogenic shock, cardiac arrest, and hypoxic brain injury from public reports.² Massachusetts developed "compassionate use" criteria that were incorporated into risk-adjustment methodology as well as "exceptional risk" criteria by which patients were excluded from reports.³

As states have initiated their own public reporting initiatives, a wealth of evidence has accrued regarding the impact of public reporting on AMI outcomes, though findings have predominately differed. A study by Joynt et al. Medicare beneficiaries found no difference in 30-day acute myocardial infarction mortality rates in public reporting states (New York, Massachusetts, Pennsylvania) compared with non-reporting states. For Massachusetts in particular, AMI mortality rates prior to and following implementation of public reporting did not differ from non-reporting states.⁴ A subsequent study by Waldo and colleagues found that in-hospital mortality rates following AMI were higher in reporting versus non-reporting states (odds ratio 1.21; 95% confidence interval 1.06–1.37).⁵ This finding was primarily driven by high mortality rates in AMI patients not offered PCI, while mortality rates were lower in AMI patients that ultimately underwent PCI in reporting states. The latter finding was also observed in an analysis by Cavender et al. of the CathPCI national registry – adjusted in-hospital mortality was lower among patients that underwent PCI for acute coronary syndrome in reporting compared with non-reporting states (OR 0.81; 95% CI 0.74–0.89).⁶

Despite that the intent of reporting programs is to improve quality of care, very few studies have actually characterized the impact of public reports on process and performance measures.⁶ It is still unclear whether public reports actually improve care delivery before and after PCI, and if they motivate refinements in operator skillset, likely because the latter is difficult to measure. In the absence of this information, data on PCI outcomes in isolation is challenging to interpret as it is unclear to what extent variations in outcomes reflect true improvements in quality rather than provider risk aversion.

Risk Aversion – A Reality of Public Reporting

The evidence to date clearly shows that coronary angiography and PCI utilization is lower in public reporting states for AMI, and also decreases after implementation of reporting programs.⁴⁻⁷ Though this may in part reflect more appropriate case selection, it is more likely that there are differences in how critically-ill patients, who potentially stand to gain the most from PCI, are chosen for intervention in reporting compared with non-reporting states.

Early data from New York, a reporting state, observed that patients were significantly less likely to undergo PCI for AMI, and were nearly seven times less likely to receive PCI for cardiogenic shock, when compared to Michigan (non-reporting state).⁸ A subsequent study of New York found that individuals with AMI and cardiogenic shock had a lower likelihood of undergoing coronary angiography and PCI compared to counterparts in non-reporting states, highlighting that the decision to not perform PCI in critically-ill patients was made without an understanding of their coronary anatomy.⁷ The more recent study of Medicare Beneficiaries by Joynt and colleagues showed that patients with cardiogenic shock or cardiac arrest were significantly less likely to undergo PCI in reporting states compared with non-reporting states (OR 0.79, 95% CI 0.64–0.98). This pattern was similar for patients with ST-segment elevation MI (STEMI). In the state of Massachusetts in particular, the likelihood of undergoing PCI for cardiogenic shock or cardiac arrest decreased dramatically following implementation of a state reporting program.⁴ Additionally, the Waldo et al. analysis found that in reporting states, the odds of PCI was nearly over 40% lower in patients with cardiac arrest or cardiogenic shock and similarly reduced in patients with STEMI, compared with non-reporting states.⁵ In all of these studies, the lower rates of PCI in reporting states was far more pronounced for patients with cardiogenic shock (or cardiac arrest) than other non-high-risk AMI patients (Table 1). Collectively, these data suggest that operators in public reporting states may have a higher threshold, or even potentially avoid, performing PCI on critically-ill patients who may benefit the most from revascularization relative to non-reporting states.

Public Reports and Provider Behavior

Aversion to performing PCI, particularly in high-risk patients, is a clear unintended consequence of reporting programs, but should perhaps come as no surprise. A survey of interventional cardiologists from New York found that the vast majority felt that the publication of mortality statistics, in some instances, had influenced their decision to perform PCI.⁹ Furthermore, surveyed physicians also expressed increased reluctance to

intervene in critically-ill patients and (83%) acknowledged that patients who might benefit from revascularization may not receive it due to public reports.¹⁰ The transparency component of public reports likely does, in some instances, motivate improvements in care quality through multiple mechanisms and enhance provider decision-making. However, the knowledge that a providers' outcomes will be publicly disclosed potentially imposes an unintentional pressure to avoid cases with a higher likelihood of poor outcomes, such as patients with cardiogenic shock or cardiac arrest, rather than risk being "publicly shamed" due to poor outcomes. Furthermore, there is still conflicting evidence as to whether the public identification component of reporting – the labeling of providers or institutions as negative outliers in terms of PCI outcomes – truly does improve performance in subsequent years, or instead, promotes risk avoidance.^{11,12} It is essential that reporting initiatives continue to seek how to best optimize PCI care quality, delivery and performance, while also discouraging adverse physician behaviors, such as risk aversion in critically-ill patients that may benefit from PCI.

Exclusion of High-Risk Patients from Public Reports

Refractory Cardiogenic Shock

One example of how public reporting policy evolved in an attempt to mitigate risk averse behaviors that were potentially detrimental to high-risk patients began in New York State. In 2006, the New York State Department of Health decided to begin a trial of excluding patients with refractory cardiogenic shock from public reports.² Though this was primarily driven by concern regarding risk aversion towards critically-ill patients who could potentially benefit from PCI, other factors also contributed.¹³ For example, cardiogenic shock reflects a confluence of variables that are likely unrelated to actual PCI, risk-adjustment may not fairly account for such extreme clinical scenarios, and institutional volume of cardiogenic shock patients may have a disproportionate impact on risk-adjusted outcomes.^{14,15}

Two separate studies analyzed the effect of New York State's decision to exclude patients with refractory cardiogenic shock from reports. One analysis using New York data from 2002 to 2012 demonstrated that patients with AMI and cardiogenic shock were significantly more likely to undergo PCI after the exclusion policy was enacted (adjusted relative risk 1.28; 95% CI, 1.19–1.37).¹⁶ More importantly, the risk-adjusted in-hospital mortality rates for patients with AMI and cardiogenic shock decreased following the policy change (RR 0.76; 95% CI, 0.72–0.81, Figure 1). In 2008 the New York State Department of Public Health decided to permanently enact the policy to exclude patients with cardiogenic shock from public reports. A different analysis showed that a significantly higher proportion of patients underwent PCI after the permanent exclusion of refractory cardiogenic shock patients from reports (OR 1.50; 95% CI, 1.12–2.01), though notably, these trends paralleled other non-reporting states during the same period.¹⁷ These findings were in line with a survey of interventional cardiologists from New York, which revealed that the majority felt that the exclusion of refractory shock made them more likely to perform PCI in these patients.⁹ It is clear that the exclusion policy led to providers becoming less risk-averse –

consequently, they performed more PCIs in patients with cardiogenic shock, which was associated with improved survival in this high-risk population.

Notably, in both studies, rates of PCI in New York still remained significantly lower than other non-reporting states even years after the exclusion of cardiogenic shock patients. It is likely that this reflects residual risk aversion towards this patient population despite policy efforts, though it is also possible providers are more likely to turn down futile and/or inappropriate cases in reporting states. Nonetheless, these data demonstrate the pronounced and persistent effect of public reporting on physician behavior. Although exclusion policies reduced risk aversion and improve mortality in cardiogenic shock cases in New York, such shifts in policy have not fully reversed the clinical decision-making and practice patterns that developed initially in response to original public reporting programs. These studies raise the interesting question of whether exclusion policies established from the outset would mitigate physician tendencies toward risk aversion in states looking to adopt public reporting in the future.

Out-of-Hospital Cardiac Arrest

Both the American Heart Association and the American College of Cardiology Interventional Council have advocated for the exclusion of out of hospital cardiac arrest patients from public reports.^{15,18,19} This again, has been motivated by the fact that cardiac arrest patients are at very high risk of death irrespective of PCI and due to concern that providers may be averse to performing a potentially life-saving procedure in these patients due to concern about public reports. In 2010, New York State began to exclude selected patients with cardiac arrest and coma from publicly reported mortality statistics, though there is no evidence that this was associated with significant changes in rates of PCI or in-hospital mortality.¹⁹ And though Massachusetts does not formally exclude all out of hospital cardiac arrest patients, it no longer includes patients with ongoing CPR at the start of PCI and now formally includes “compassionate use” criteria for formal inclusion in risk adjustment methods as well as “exceptional risk” criteria for exclusion of cases from public reports.³

Future Efforts

Though the exclusion of some high-risk patients from public reports represent a step in the right direction to diminish risk-aversion, a number of challenges and limitations remain related high-risk patients in reporting states. Critically-ill patients that might benefit from PCI but do not meet formal exclusion criteria from reports, such as non-refractory cardiogenic shock patients, may still be susceptible to provider risk averse behaviors.⁹ Furthermore, in order for public reports to provide fair comparisons of performance, it is critical that differences in patient risk profiles are accurately accounted for, particularly for providers and tertiary care institutions that take on complex, high-risk patients, such as surgically ineligible patients.²⁰ However, risk adjustment models may not effectively account for high-risk clinical variables, the spectrum of illness related to a comorbidities, nor covariates that are not captured in registry data.²¹ Given these limitations, it is also important to consider whether public reports of high-risk patients provide a fair reflection of

provider or institutional care quality since mortality in these patients is likely driven by numerous unmeasured patient-level factors, rather than procedural performance.

Several strategies could potentially improve reporting efforts and simultaneously reduce provider aversion towards performing PCI in high-risk patients. Evaluating provider and institutional performance by processes of care and evidenced-based adherence measures, rather than PCI mortality, may more accurately reflect care quality. In addition, reporting disease-rather than procedure-based outcomes could provide a more comprehensive picture of performance, irrespective of therapy chosen (i.e. CABG, PCI, medical therapy), and eliminate the pressure reporting imposes of providers to avoid high-risk cases due to concerns about their PCI-specific outcomes being publicly disclosed.

Conclusion

Public reporting initiatives for PCI are beginning to proliferate nationally.²² However, the evidence to date does not convincingly show that public reports improve PCI outcomes. In fact, there is more persuasive evidence to show that reporting may foster an aversion to performing PCI in high-risk patients. In a way, it is intuitive that reporting of outcomes might perversely incentivize avoidance of severely ill patients that are at greater risk for death, due to provider fears of the adverse professional consequences if poor outcomes are made public. Shifts in policy, such as the exclusion of refractory cardiogenic shock and out-of-hospital cardiac arrest patients in New York state, appear to have helped reduce risk averse behaviors and improved patient outcomes.^{16,17,23} However, the challenge of fostering the positive of aspects of reporting, which incentivize improved care quality and procedural performance, while ensuring that high-risk patients continue to receive appropriate care remains. It is imperative that policymakers and cardiologists develop innovative solutions that both strengthen reporting initiatives and address risk averse behaviors towards critically-ill patients, such as those with cardiogenic shock, whom stand to potentially benefit from revascularization.

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Figure 1.

Adjusted Relative Risk (aRR) of Percutaneous Coronary Intervention (left) and In-Hospital Mortality (right) for Patients with Cardiogenic Shock per Year Compared with Non-New York States in 2002. Used with permission from American Medical Association.

* Error bars indicate 95% confidence intervals

Table 1

Percutaneous Coronary Intervention for High-Risk Patients in Reporting vs. Non-Reporting States

Study	Odds ratio (OR) of PCI in Reporting vs. Non-Reporting States (95% confidence interval; p value)		
	AMI	Cardiogenic Shock or Cardiac Arrest	STEMI
<i>Apolito et al., 2008</i> ⁷		OR 0.51 (0.33–0.72; p<0.001) ^a	
<i>Joynt et al., 2012</i> ⁴	OR 0.82; (0.71–0.93; p=0.003) ^b	OR 0.79; (0.64–0.98; p=0.03) ^b	OR 0.73; (0.59–0.89; p=0.002) ^b
<i>Waldo et al., 2015</i> ⁵	OR 0.81; (0.67–0.96; p<0.017) ^c	OR 0.58; (0.47–0.70; p<0.001) ^c	OR 0.63; (0.62–0.91; p=0.001) ^c

^aAdjusted for propensity score^bAdjusted for patient demographics and medical comorbid conditions^cMultivariate adjustment