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Indications for percutaneous coronary interventions performed in U.S. Hospitals: a report from the National Cardiovascular Data Registry

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Abstract

Background—There are many factors hypothesized as contributing to overuse of percutaneous coronary intervention (PCI) in the United States (U.S.), including financial ties between physicians and hospitals, but empirical data are lacking. We examined PCI indications in not-for-profit (NFP), major teaching, for-profit (FP) and physician-owned specialty hospitals.

Methods—A retrospective cohort study of 1,113,554 patients who underwent PCI in 694 hospitals (NFP=471, teaching=131, FP=79, specialty=13) participating in the National Cardiovascular Data Registry® (NCDR®) CathPCI Registry® between January 1, 2004 and December 31, 2007. PCI indications derived from American College of Cardiology (ACC) Guidelines were classified as: survival benefit (patients with primary reperfusion for STEMI); potential quality of life (QOL) benefit (patients with NSTEMI, ACS, positive stress test, or chest pain); or unclear indications (patients receiving PCI without an obvious potential survival or QOL benefit).

Results—The percentage of PCI performed for unclear indications was somewhat higher for specialty hospitals (5.1% of all procedures) as compared with other hospital categories (FP 4.7%, NFP 4.2%, teaching 4.5%; $P<0.001$). Overall, 17% of hospitals had 20% or more of their total PCI procedures performed for unclear indications but the proportion of FP, NFP, teaching, and specialty hospitals reaching this threshold was not statistically different (20%, 16%, 17% and 15% respectively; $P=.84$).

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Conclusions—A small proportion of PCI procedures were performed in patients with unclear indications, but there was wide variation across hospitals. On average, specialty hospitals performed more PCIs for unclear indications. Efforts to reduce variability should be pursued.

Introduction

Percutaneous coronary intervention (PCI) use has increased by more than 60% over the past 15 years.¹ In the United States (U.S.) alone, an estimated 600,000 PCIs are performed annually at a direct cost of approximately \$30 billion,²⁻⁴ with similar trends in Europe and Canada.⁵⁻⁷ The growth of PCI in the U.S., especially among patients without an acute ST-Elevation myocardial infarction (STEMI), may be encouraged by the generous reimbursement for interventional procedures as compared with medical therapy, which may unintentionally promote overuse of PCI.^{7,8} In addition, policy makers and health economists have suggested that complex financial ties between physicians and hospitals may provide additional financial incentives to perform PCI in patients who could be treated effectively with medical therapy alone. For example, physicians may partner with corporate investors to purchase partial ownership of a hospital (i.e., a physician-owned hospital) or develop profit-sharing agreements in which hospitals share profits with physicians.⁹⁻¹¹

To address the issue of potential overuse, the American College of Cardiology (ACC), in partnership with six other professional organizations, have created the Appropriate Use Criteria (AUC) for categorizing strength of the decision to proceed with coronary revascularization.¹² The underlying strategy used to assign ratings to various clinical indications was the potential for revascularization to either extend life or improve patients' symptoms. A recent report from the ACC National Cardiovascular Data Registry (NCDR) found that 1.1% of procedures for acute coronary syndromes (representing 71.1% of all PCIs) and 10.2% of elective procedures were inappropriate according to AUC criteria.¹³

Given concerns about the potential association between hospital governance/financial structure and potential overuse of PCI, we sought to compare PCI indications for patients treated in four distinct groups of hospitals: 1) not-for-profit (NFP) hospitals; 2) major teaching hospitals; 3) for-profit (FP) hospitals; and 4) physician-owned specialty hospitals. Our primary goal was to examine the indications for PCI as a function of hospitals' governance structures, so as to inform public policy with empirical data about the potential implications of varying financial relationships between hospitals and physicians.

Methods

Data

We used Medicare Provider and Analysis Review (MedPAR) Part A public use files to identify all hospitals performing one or more PCIs between 2001-2005 on the basis of International Classification of Diseases, 9th Clinical Modification (ICD-9-CM) procedure codes (36.01, 36.02, 36.05, and 36.06 (N= 1,609 hospitals). The Part A files contain discharge abstract data for all fee-for-service Medicare patients discharged from acute care hospitals with the exception of Medicare managed care enrollees.¹⁴ Data elements relevant to the current study included the name and location of each hospital and each hospital's Medicare provider number.

We then identified key organizational characteristics for each hospital that allowed us to stratify hospitals into four categories: 1) not-for-profit (NFP) hospitals; 2) major teaching hospitals; 3) for-profit (FP) hospitals; and 4) physician-owned specialty hospitals. We determined whether hospitals were physician-owned specialty cardiac hospitals by comparing the names and locations of hospitals in the MedPAR data with lists of physician-

owned hospitals published by government regulators.^{10,15} We determined for-profit/not-for-profit status and hospital teaching status by linking each hospital identified in the MedPAR data to the 2005 American Hospital Association (AHA) annual survey data using the hospital provider numbers; hospitals were classified as teaching hospitals if they reported membership in the council of teaching hospitals (COTH).¹⁶

Because individual hospitals could meet the criteria for multiple hospital categories simultaneously (e.g., a hospital could be both for-profit and major teaching), we made an a priori decision to assign hospitals into categories in the following hierarchical order: 1) specialty hospitals; 2) major teaching hospitals; 3) for-profit hospitals; and 4) not-for-profit hospitals. For example, if a hospital was both a specialty hospital and not-for-profit, for the purposes of this study it was categorized as a specialty hospital. Likewise, if a hospital was both a major teaching hospital and not-for-profit, it would be categorized as a major teaching hospital. This classification scheme resulted in the identification of 1,037 not-for-profit, 262 teaching, 287 for-profit and 23 physician-owned specialty hospitals in the Medicare data.

We then used the American College of Cardiology (ACC) National Cardiovascular Data Registry® (NCDR®) CathPCI Registry® to identify all patients who underwent PCI between January 1, 2004 and December 31, 2007.^{17,18} While the data elements to calculate the AUC were not available in version 3 of the NCDR data collection forms, the availability of a much larger data set and the ability to mirror the AUC from available data, supported the use of these data. Data elements within version 3 of the NCDR include patient demographics (e.g., age, race, sex), cardiovascular risk factors (e.g., diabetes, hypertension) and comorbidities (e.g., COPD), signs, symptoms and use of diagnostic tests (e.g., stress test results, EKG findings), cardiac medications, coronary anatomy, procedural success, complications, discharge medications, and the hospital where each procedure was performed. Only data meeting criteria for completeness and accuracy, as determined by the NCDR®'s data quality and auditing system are entered into the NCDR® (details available at <https://www.ncdr.com>). A total of 889 hospitals located in the U.S. reported PCI data to the NCDR between January 1, 2004 and December 31, 2007. We excluded 52 hospitals that submitted less than 90 days of data and/or performed less than 10 PCI's per year, resulting in identification of 837 eligible hospitals in the CathPCI registry (see Figure 1).

We then attempted to match each eligible hospital in the CathPCI registry with the corresponding data on hospital ownership, teaching status, and for-profit/not-for-profit status, as derived from the MedPAR and AHA data. Because the CathPCI registry does not include hospital Medicare provider numbers or AHA identification numbers, we matched hospitals in the CathPCI registry with the MedPAR data using hospital name and location (city and state); when uncertainty arose in the matching (e.g., hospital city and state matched but names differed slightly) we reviewed hospital web sites for additional information. Using these factors we were successfully able to match 694 of the 837 eligible hospitals (83%) in the CathPCI registry to hospitals in the MedPAR data (see Figure 1). Our study sample involved all patients who received PCI at any of the 694 study hospitals, with the exception of PCI recipients who received their interventions as part of an organ transplant evaluation (n=1495 patients) as PCI indications in such a population are not covered by existing guidelines. Of these hospitals 471 (68%) were NFP, 131 (19%) were teaching, 79 (11%) were FP, and 13 (2%) were specialty hospitals.

Classification of PCI Indications

We assessed the indications for each PCI by applying the aforementioned framing of the AUC and the 2001 ACC guidelines.¹⁹ This approach is inherently complicated and required a number of simplifying assumptions. Given the complexity of these mappings, we were

deliberately conservative in classifying patients as having unknown (potentially inappropriate) indications for PCI, knowing that many of the treated patients could likely be managed equally well with medications or revascularization. All patients undergoing primary PCI for an ST-elevation myocardial infarction (STEMI) were categorized as appropriate because of the potential survival benefit associated with primary PCI for STEMI. Patients with atypical chest pain, stable angina, unstable angina, a positive stress test or non ST-elevation myocardial infarction (NSTEMI) were also categorized as appropriate because of the potential benefits offered by PCI in symptomatic patients.²⁰ We recognized that some of these PCI are likely not appropriate (e.g., a patient with atypical chest pain and a negative stress test) but in the absence of data on severity of symptoms, or use of optimal medical therapy, we gave such cases the “benefit of the doubt” and categorized them as offering potential benefit. Only patients who underwent elective PCI without documented angina, typical or atypical chest pain, or a positive stress test were classified as having an unclear indication for their procedure. This clinical logic is supported by the recently published appropriate use criteria for coronary revascularization, in which less than a third of the rated clinical scenarios in asymptomatic patients were judged to be appropriate (and none of those with low-risk ischemia, regardless of the intensity of medical therapy), as compared with 60% of the same scenarios among those with CCSC (Canadian Cardiovascular Society Classification) Class I/II angina and 83% of the Class III/IV patients.⁸ Thus, each patient’s PCI was categorized as providing benefit, potential benefit, or being performed for unclear indications. Detailed information on these assumptions and related coding is available from the authors by request.

Analyses

We first compared the structural and organizational characteristics of the four categories of hospitals (NFP, teaching, FP, or specialty) including geographic location, bed size and PCI volume, using student t-tests for continuous and χ^2 tests for categorical data. Similar tests were then used to compare the characteristics of patients treated within each of these hospital groups including demographic characteristics, comorbidity, and clinical characteristics.

We then used univariate and bivariate methods to compare PCI indications in each of the four hospital groups. In particular, we compared the proportion of PCIs in each category of hospitals performed for STEMI, for potential benefit, and for unclear indications. In an effort to examine whether PCI for unclear indications might be clustered within specific hospitals, we calculated the proportion of each hospital’s total PCI volumes for the study period that were performed for unclear indications. We then used graphical and univariate techniques to examine the distribution of the percentage of PCIs performed for unclear indications among each of the four hospital categories to explore whether specific hospital types might perform a larger (or smaller) proportion of PCIs for unclear indications.

Statistical significance was defined as $P \leq 0.05$. Analyses were conducted using SAS Version 9.1 (SAS Institute, Cary, NC). These analyses were approved by the IRBs at the University of Iowa and Saint Luke’s Hospital of Kansas City. The authors had full access to the data and attest to its accuracy. This work was funded by grants from the Robert Wood Johnson Foundation (Dr. Cram) and the National Heart, Lung, and Blood Institute at the NIH (R01 HL085347; Drs. Cram and Spertus). Dr. Spertus and the MidAmerica Heart Institute receive funding through a contract from the ACC related to the analysis of the Cath-PCI Registry. The funding agencies played no role in the data analysis, data interpretation or drafting of this manuscript. This manuscript did undergo review and editing by the NCDR Research and Publication Committee in accordance with ACC protocols and policies.

Results

Our study sample consisted of 1,113,554 patients admitted to 694 hospitals. The majority of hospitals in our sample were not for profit, and most of the specialty hospitals are in the South (Table 1). Major teaching hospitals tended to be larger and specialty hospitals smaller as compared with NFP and FP hospitals. Likewise, major teaching hospitals and specialty hospitals were more likely to have cardiac surgery backup and performed higher volumes of PCI, as compared with NFP and FP hospitals.

Women made up approximately one third of patients across hospitals and the highest percentage of Caucasian patients were seen at specialty hospitals (Table 2). Patients receiving PCI in major teaching hospitals were younger and more likely to be male, while patients in FP hospitals were more likely to be admitted through the emergency department. Likewise, patients receiving PCI in specialty hospitals were older and more likely to have had prior revascularization (PCI or CABG), but had lower acuity, including cardiogenic shock. Specialty hospitals conducted significantly more procedures on elective patients referred from the outpatient setting.

Among all PCI patients, 16% (175,442) were performed for STEMI while 4% (48,424) were performed for patients with unclear indications (Table 3). The proportion of PCIs performed for patients with STEMI varied from 16.7% in for-profit hospitals to 12.1% in specialty hospitals (a 38% relative difference, $P<0.001$). Alternatively, the proportion of PCI performed for patients with unclear indications varied from 4.2% in not-for-profit hospitals to 5.1% in specialty hospitals (a 21% relative difference, $P<0.001$).

Looking at our data from the hospital perspective, rather than the patient perspective, the proportion of patients undergoing PCI for unclear indications ranged from 0-80% (Figure 2). There were 116 hospitals (17% of all study hospitals; performing 13% of all procedures included in this study) that had 20% or more of their respective hospital's PCI procedures performed for unclear indications. This included 76 NFP hospitals (16% of all not-for-profit hospitals), 22 teaching hospitals (17% hospitals), 16 FP hospitals (20% of all FP hospitals), and 2 specialty hospitals (15% of specialty hospitals).

Discussion

In an analysis of data from a large registry of U.S. patients who underwent PCI, we found that overall, a small proportion of procedures (4%) were performed for patients with no clear benefit from the procedure. We found only modest variation among the different hospital organizational structures, with specialty hospitals performing the greatest proportion of PCIs with unclear indications. However, there was marked variation among individual hospitals, with 17% of hospitals providing more than 1 in 5 of their PCIs in patients who would not obviously benefit from the procedure in terms of improved survival or QOL. These variations in patient selection across institutions underscore the opportunity to create and apply more explicit methods for quantifying the appropriateness of interventional procedures.

A number of our findings merit further discussion. First, our finding that 4% of all PCI procedures were performed for unknown indications requires careful consideration. We were very conservative in categorizing the indications for procedures. In particular, we defined all procedures performed for STEMI as providing survival benefit, even though some were not for primary reperfusion. Likewise, all procedures performed on patients with chest pain, acute coronary syndromes, or a positive stress test were categorized as providing potential benefit, although data suggest that many of these patients could be treated successfully with medical management alone.²¹ For example, a patient with atypical chest

pain in the absence of a positive stress test was liberally considered to have QOL benefit in our analysis. Thus, a PCI was only categorized as being performed for unclear indications in the absence of any potential patient-centered benefit from the procedure. Importantly, our estimate in these data is extremely close to the overall estimate of inappropriate PCIs by Chan et al. which was 3.74%.¹³

While a 4% rate of potentially inappropriate procedures with unclear indications may seem small, if 1 in 25 PCI procedures could be avoided, the economic impact could be substantial. Extrapolating our findings to the estimated 600,000 PCIs performed each year in the U.S., 24,000 of these procedures might be avoidable.⁴ Assuming an average reimbursement of \$35,000 per procedure, this would translate into a cost of \$ 840 million/year.^{2,22} Moreover, potentially avoidable procedures expose patients to pain, procedural risks, and potential long-term consequences related to stent implantation, such as late-stent thrombosis and the need for dual anti-platelet therapy and increased bleeding risk.

It is also noteworthy that we found relatively little variation in indications for procedures among NFP, major teaching, FP and specialty hospitals. As in prior studies, we did find some evidence that specialty hospitals admitted patients with less acuity than other types of hospitals.^{15,23} In particular, we found that specialty hospitals admitted a smaller proportion of patients through the emergency department, performed 3% fewer procedures for STEMI and approximately 0.5% more procedures for unclear indications. The mechanism by which specialty hospitals attract less acute patients remains uncertain, since prior studies have demonstrated that, in contrast to specialty orthopaedic and surgical hospitals, all specialty hospitals have emergency departments. The differences in PCI indications between the different types of hospitals that were the subject of our study were modest when compared to the variation seen across hospitals, irrespective of their organizational structures. In particular, our finding that 17% of all study hospitals had 20% or more of their total PCI volume performed for unknown indications is striking. Future investigation should attempt to determine the underlying cause of this variation, be it inadequate documentation, patient preference, or truly large numbers of inappropriate procedures in specific hospitals.

A number of additional findings merit brief mention. The future of physician owned specialty hospitals has dimmed in recent years. The Affordable Care Act extends the Stark Law by substantially restricting physician investment in whole hospitals.^{24,25} The results of the current study and our companion manuscript (will add ref once available) provide additional data that an outright ban on physician ownership may modestly reduce potentially inappropriate procedures at the cost of eliminating a group of hospitals with seemingly excellent outcomes. It is also interesting to note differences in the ratio of diagnostic catheterizations to interventions in our study. Specifically, not-for-profit hospitals performed 2.6 diagnostic catheterizations per-intervention versus 2.7 for major teaching, 3.1 for for-profit, and 1.8 for specialty hospitals. This suggests potentially important differences in the tendency to intervene across hospital groups- an area in need of future study.

There are several potential limitations to our study that should be considered when interpreting our findings. First, while we used a clinical registry with a rigorous data collection protocol, the possibility for coding anomalies, either deliberate or accidental, would influence our findings. The current ACC audit system does not validate the veracity of all clinical data elements, although some state-wide, NCDR-based, quality assessment programs do independently adjudicate critical elements.²⁶ Second, because participation in the CathPCI registry is voluntary, it is likely that hospitals participating in the registry are not representative of all U.S. hospitals and give higher quality care than those who do not participate.²⁷ Likewise, our inability to link all hospitals that did participate in the registry to the Medicare data is a potential source of bias. Fourth, our determination of PCI indications

was based upon information included in the CathPCI registry and, as noted above, are designed to be extremely inclusive of patients with potential benefits from PCI. The similarity in rates with those recently reported using the AUC from Version 4 of the NCDR, are reassuring of our approach to categorizing potentially inappropriate PCIs. Finally, our stratification of hospitals into four groups is coarse and does not allow us to examine heterogeneity that might occur among hospitals within a given category.

In summary, we found that 4% of all PCI procedures in a large clinical registry were performed for unknown clinical indications. While variation in PCI indications across the hospital governance groups (NFP, teaching, FP, and specialty) was relatively modest, there was a large amount of variation in PCI indications within each of the groups. The finding that a large proportion of hospitals in each group performed over 20% of their PCI procedures for unclear indications warrants further investigation. Better understanding the reasons for these variations may lead to improvements in assessing and improving the selection of patients for PCI.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Flow chart for hospital selection

Figure 2. Distribution of the average percentage of PCI performed within individual hospitals for unknown indications by hospital category.

Table 1
 Characteristics of not for-profit, major teaching, for-profit, and physician-owned specialty hospitals

<i>Hospital Characteristics</i>	Not for-profit n = 471	Major teaching n = 131	For-profit n = 79	Physician-owned specialty n = 13	P-Value
<i>Hospital Region</i>					
1 = West	110 (23.35%)	13 (9.92%)	27 (34.18%)	2 (15.38%)	< 0.001
2 = Northeast	50 (10.62%)	33 (25.19%)	1 (1.27%)	0 (0.00%)	
3 = Midwest	166 (35.24%)	46 (35.11%)	6 (7.59%)	5 (38.46%)	
4 = South	145 (30.79%)	39 (29.77%)	45 (56.96%)	6 (46.15%)	
Hospital Beds, Mean (sd)	351.64 ± 165.46	614.13 ± 224.96	290.29 ± 145.52	96.77 ± 129.15	< 0.001
Surgical Backup, number (%)	386 (81.95%)	125 (96.15%)	56 (71.79%)	12 (92.31%)	< 0.001
PCI Volume, Mean (sd)	627.62 ± 496.24	966.94 ± 668.84	405.58 ± 334.32	1053.31 ± 505.65	< 0.001
Diagnostic Cath Volume, Mean (sd)	1635.94 ± 1223.64	2645.27 ± 1857.54	1292.65 ± 969.13	1974.92 ± 1110.56	< 0.001
Number of days in this study					< 0.001
Mean ± SD	865.22 ± 317.58	819.75 ± 352.65	628.35 ± 341.19	970.38 ± 367.84	
Min	90.00	92.00	90.00	183.00	
Max	1454.00	1459.00	1327.00	1379.00	

Table 2

Characteristics of patients treated in study hospitals

	Not for Profit n = 713642	Major Teaching n = 308372	For Profit n = 54545	Specialty n = 36995	P-Value
Demographics					
Patient Age Years, mean (sd)	64.21 ± 12.15	63.84 ± 12.23	64.20 ± 12.24	65.16 ± 11.95	< 0.001
Gender, number (%)					< 0.001
Male	472904 (66.27%)	207244 (67.21%)	36339 (66.62%)	24194 (65.40%)	
Female	240738 (33.73%)	101128 (32.79%)	18206 (33.38%)	12801 (34.60%)	
Race/Ethnicity, number (%)					< 0.001
Caucasian	621344 (87.16%)	259142 (84.16%)	44107 (80.95%)	33299 (90.07%)	
Black	38178 (5.36%)	25471 (8.27%)	3439 (6.31%)	1700 (4.60%)	
Hispanic	17313 (2.43%)	6782 (2.20%)	3563 (6.54%)	1526 (4.13%)	
Asian	9573 (1.34%)	2929 (0.95%)	702 (1.29%)	112 (0.30%)	
Native American	1944 (0.27%)	655 (0.21%)	499 (0.92%)	43 (0.12%)	
Other	24523 (3.44%)	12950 (4.21%)	2176 (3.99%)	291 (0.79%)	
Admission Source, number (%)					< 0.001
Outpatient Referral	318427 (44.63%)	136032 (44.12%)	24528 (45.00%)	22212 (60.05%)	
Emergency Department	237108 (33.23%)	75522 (24.49%)	19926 (36.56%)	6245 (16.88%)	
Transfer-Acute Care Facility	138449 (19.40%)	87545 (28.39%)	8440 (15.48%)	7066 (19.10%)	
Transfer-Non-Acute Care Facility	8888 (1.25%)	3627 (1.18%)	500 (0.92%)	1340 (3.62%)	
Other	10609 (1.49%)	5603 (1.82%)	1113 (2.04%)	127 (0.34%)	
Inpatient Status at time of PCI	606149 (84.95%)	264766 (85.87%)	45849 (84.07%)	30849 (83.39%)	< 0.001
Insurance Payer, number (%)					< 0.001
Government	373753 (52.39%)	158080 (51.28%)	28706 (52.67%)	21838 (59.03%)	
Commercial	224753 (31.50%)	87834 (28.50%)	15866 (29.11%)	11251 (30.41%)	
HMO	77949 (10.93%)	45058 (14.62%)	7212 (13.23%)	2162 (5.84%)	
None	36591 (5.13%)	16734 (5.43%)	2669 (4.90%)	1723 (4.66%)	
Non U.S. Insurance	413 (0.06%)	534 (0.17%)	51 (0.09%)	19 (0.05%)	
Comorbidities					
Comorbidities, number (%)					
Previous MI (>7 Days)	190691 (26.72%)	92681 (30.06%)	14262 (26.15%)	11601 (31.36%)	< 0.001
CHF	70964 (9.94%)	33417 (10.84%)	5450 (9.99%)	4727 (12.78%)	< 0.001

	Not for Profit n = 713642	Major Teaching n = 308372	For Profit n = 54545	Specialty n = 36995	P-Value
Previous Valvular Surgery	7462 (1.05%)	3756 (1.22%)	579 (1.06%)	512 (1.38%)	< 0.001
Previous Cardiac Transplant	1021 (0.14%)	803 (0.26%)	244 (0.45%)	27 (0.07%)	< 0.001
Previous CABG	131307 (18.40%)	58913 (19.11%)	9511 (17.44%)	8812 (23.82%)	< 0.001
Previous PCI	257899 (36.14%)	108437 (35.17%)	18474 (33.87%)	15832 (42.79%)	< 0.001
Diabetes	230620 (32.32%)	103425 (33.54%)	17961 (32.93%)	11987 (32.40%)	< 0.001
Previous History - Renal Failure	35936 (5.04%)	18331 (5.94%)	2906 (5.33%)	1943 (5.25%)	< 0.001
Cerebrovascular Disease	80858 (11.33%)	34282 (11.12%)	6016 (11.03%)	4928 (13.32%)	< 0.001
Peripheral Vascular Disease	81008 (11.35%)	37192 (12.06%)	7061 (12.95%)	5368 (14.51%)	< 0.001
Chronic Lung Disease	118482 (16.60%)	47322 (15.35%)	8651 (15.86%)	6016 (16.26%)	< 0.001
Hypertension	540865 (75.79%)	240685 (78.05%)	42083 (77.16%)	28947 (78.25%)	< 0.001
Dyslipidemia	528573 (74.08%)	239424 (77.65%)	40715 (74.67%)	27387 (74.03%)	< 0.001
Clinical Presentation, number (%)					
PCI Urgency					
Elective	342680 (48.03%)	148546 (48.17%)	29594 (54.26%)	18919 (51.16%)	< 0.001
Urgent	256444 (35.94%)	111531 (36.17%)	15514 (28.44%)	14352 (38.81%)	
Emergency	112506 (15.77%)	47376 (15.36%)	9305 (17.06%)	3531 (9.55%)	
Salvage	1915 (0.27%)	902 (0.29%)	130 (0.24%)	178 (0.48%)	
NYHA					
Class 1	232299 (32.56%)	95520 (30.98%)	20876 (38.29%)	4616 (12.48%)	< 0.001
Class 2	155981 (21.86%)	62768 (20.36%)	13439 (24.65%)	12631 (34.14%)	
Class 3	186893 (26.19%)	84296 (27.34%)	11146 (20.44%)	14880 (40.22%)	
Class 4	138324 (19.39%)	65749 (21.32%)	9065 (16.63%)	4868 (13.16%)	
Cardiogenic Shock	15383 (2.16%)	6599 (2.14%)	1333 (2.44%)	453 (1.22%)	< 0.001
Ejection Fraction, mean (sd)	52.87 ± 12.80	51.41 ± 12.60	53.41 ± 12.48	51.35 ± 12.57	< 0.001

Table 3

PCI indications and symptoms in four categories of hospitals

PCI Indications, n(%)	Not for Profit n = 713642	Major Teaching n = 308372	For Profit n = 54545	Specialty n = 36995	P-Value
STEMI/ Survival Benefit	113913 (15.96%)*	47909 (15.54%)*	9132 (16.74%)*	4488 (12.13%)	< 0.001
Potential QOL Benefit	569594 (79.82%)*	246609 (79.97%)*	42864 (78.58%)*	30621 (82.77%)	< 0.001
Unknown Indications	30135 (4.22%)*	13854 (4.49%)*	2549 (4.67%) [†]	1886 (5.10%)	< 0.001
Symptoms/Presentation					< 0.001
No Sx/No Angina	83548 (11.71%)	37217 (12.07%)	7798 (14.30%)	4471 (12.09%)	
Atypical Chest Pain	51649 (7.24%)	17041 (5.53%)	5666 (10.39%)	1995 (5.39%)	
Stable Angina	115699 (16.21%)	53087 (17.22%)	8039 (14.74%)	6918 (18.70%)	
ACS:Unstable Angina	241858 (33.89%)	102641 (33.29%)	16501 (30.25%)	14415 (38.96%)	
ACS:Non-STEMI	106953 (14.99%)	50466 (16.37%)	7409 (13.58%)	4708 (12.73%)	
ACS:STEMI	113913 (15.96%)	47909 (15.54%)	9132 (16.74%)	4488 (12.13%)	

* p<0.001 when compared to Specialty hospital

[†] p=0.003 when compared to Specialty hospital