

## Quality of Care in Chinese Hospitals: Processes and Outcomes After ST-segment Elevation Myocardial Infarction

Nicholas S. Downing, MD; Yongfei Wang, MS; Kumar Dharmarajan, MD, MBA; Sudhakar V. Nuti, BA; Karthik Murugiah, MD; Xue Du, MD; Xin Zheng, MD, PhD; Xi Li, MD, PhD; Jing Li, MD, PhD; Frederick A. Masoudi, MD, MSPH; John A. Spertus, MD, MPH; Lixin Jiang, PhD;\* Harlan M. Krumholz, MD, SM\*\*\*

**Background**—China has gaps in the quality of care provided to patients with ST-elevation myocardial infarction, but little is known about how quality varies between hospitals.

**Methods and Results**—Using nationally representative data from the China PEACE-Retrospective AMI Study, we characterized the quality of care for ST-elevation myocardial infarction at the hospital level and examined variation between hospitals. Two summary measures were used to describe the overall quality of care at each hospital and to characterize variations in quality between hospitals in 2001, 2006, and 2011. The composite rate measured the proportion of opportunities a hospital had to deliver 6 guideline-recommended treatments for ST-elevation myocardial infarction that were successfully met, while the defect-free rate measured the proportion of patients at each hospital receiving all guideline-recommended treatments for which they were eligible. Risk-standardized mortality rates were calculated. Our analysis included 12 108 patients treated for ST-elevation myocardial infarction at 162 hospitals. The median composite rate increased from 56.8% (interquartile range [IQR], 45.9–72.0) in 2001 to 80.5% (IQR, 74.7–84.8) in 2011; however, substantial variation remained in 2011 with defect-free rates ranging from 0.0% to 76.9%. The median risk-standardized mortality rate increased from 9.9% (IQR, 9.1–11.7) in 2001 to 12.6% (IQR, 10.9–14.6) in 2006 before falling to 10.4% (IQR, 9.1–12.4) in 2011.

**Conclusions**—Higher rates of guideline-recommended care and a decline in variation between hospitals are indicative of an improvement in quality. Although some variation persisted in 2011, very top-performing hospitals missed few opportunities to provide guideline-recommended care. Quality improvement initiatives should focus on eliminating residual variation as well as measuring and improving outcomes.

**Clinical Trial Registration**—URL: <https://www.clinicaltrials.gov>. Unique identifier: NCT01624883. (*J Am Heart Assoc.* 2017;6:e005040. DOI: 10.1161/JAHA.116.005040.)

**Key Words:** China • hospital performance • quality improvement • quality measurement • variation

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# Abstract

**Background-** China has gaps in the quality of care provided to patients with ST-elevation myocardial infarction, but little is known about how quality varies between hospitals.

**Methods and Results-** Using nationally representative data from the China PEACE-Retrospective AMI Study, we characterized the quality of care for ST-elevation myocardial infarction at the hospital level and examined variation between hospitals. Two summary measures were used to describe the overall quality of care at each hospital and to characterize variations in quality between hospitals in 2001, 2006, and 2011. The composite rate measured the proportion of opportunities a hospital had to deliver 6 guideline-recommended treatments for ST-elevation myocardial infarction that were successfully met, while the defect-free rate measured the proportion of patients at each hospital receiving all guideline-recommended treatments for which they were eligible. Risk-standardized mortality rates were calculated. Our analysis included 12 108 patients treated for ST-elevation myocardial infarction at 162 hospitals. The median composite rate increased from 56.8% (interquartile range [IQR], 45.9–72.0) in 2001 to 80.5% (IQR, 74.7–84.8) in 2011; however, substantial variation remained in 2011 with defect-free rates ranging from 0.0% to 76.9%. The median risk-standardized mortality rate increased from 9.9% (IQR, 9.1–11.7) in 2001 to 12.6% (IQR, 10.9–14.6) in 2006 before falling to 10.4% (IQR, 9.1–12.4) in 2011.

**Conclusions-** Higher rates of guideline-recommended care and a decline in variation between hospitals are indicative of an improvement in quality. Although some variation persisted in 2011, very top-performing hospitals missed few opportunities to provide guideline-recommended care. Quality improvement initiatives should focus on eliminating residual variation as well as measuring and improving outcomes.

**Table.** Hospital Characteristics

	2001 (n=133)	2006 (n=151)	2011 (n=161)	<i>P</i> for Difference
Level, no. (%)				0.90
Secondary	76 (57.1)	87 (57.6)	96 (59.6)	
Tertiary	57 (42.9)	64 (42.4)	65 (40.4)	
Region, no. (%)				0.98
Eastern	55 (41.4)	60 (39.7)	64 (39.8)	
Central	42 (31.6)	48 (31.8)	48 (29.8)	
Western	36 (27.1)	43 (28.5)	49 (30.4)	
Location, no. (%)				0.99
Rural	80 (60.2)	92 (60.9)	98 (60.9)	
Urban	53 (39.8)	59 (39.1)	63 (39.1)	
Teaching hospital, no. (%)				0.66
No	47 (35.3)	56 (37.1)	65 (40.4)	
Yes	86 (64.7)	95 (62.9)	96 (59.6)	
PCI-capable, no. (%)				<0.001
No	110 (82.7)	105 (69.5)	90 (55.9)	
Yes	23 (17.3)	46 (30.5)	71 (44.1)	
Maturity (%)				<0.001
Established*	133 (100)	132 (87.4)	132 (82.0)	
New	0 (0.0)	19 (12.6)	29 (18.0)	

\*One established hospital did not treat at least 5 patients with acute myocardial infarction in all study years and was correspondingly excluded from the analysis in 2006 and 2011 per the study's inclusion criteria. PCI indicates percutaneous coronary intervention.

Median odds ratio

'01: 3.4 (2.4-4.4)  
'06: 1.8 (1.5-2.2)  
'11: 2.3 (1.9-2.6)

'01: 2.7 (2.1-3.3)  
'06: 2.6 (2.1-3.1)  
'11: 2.8 (2.3-3.3)

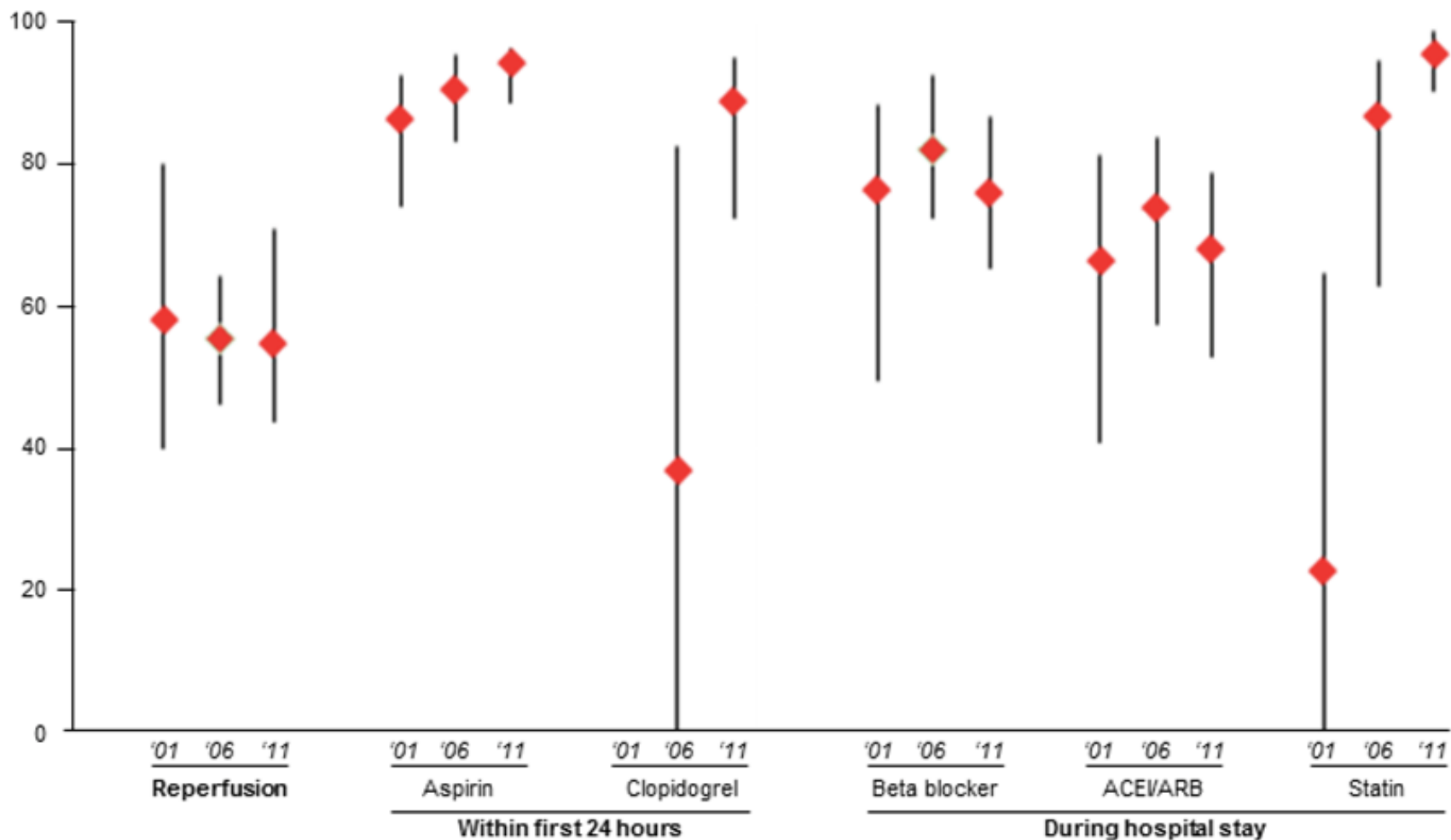
'01: n/a  
'06: 12.5 (8.5-17.6)  
'11: 6.9 (5.2-8.8)

'01: 3.3 (2.3-4.3)  
'06: 2.7 (2.1-3.4)  
'11: 2.3 (1.9-2.7)

'01: 3.0 (2.4-3.6)  
'06: 2.7 (2.2-3.1)  
'11: 2.7 (2.3-3.1)

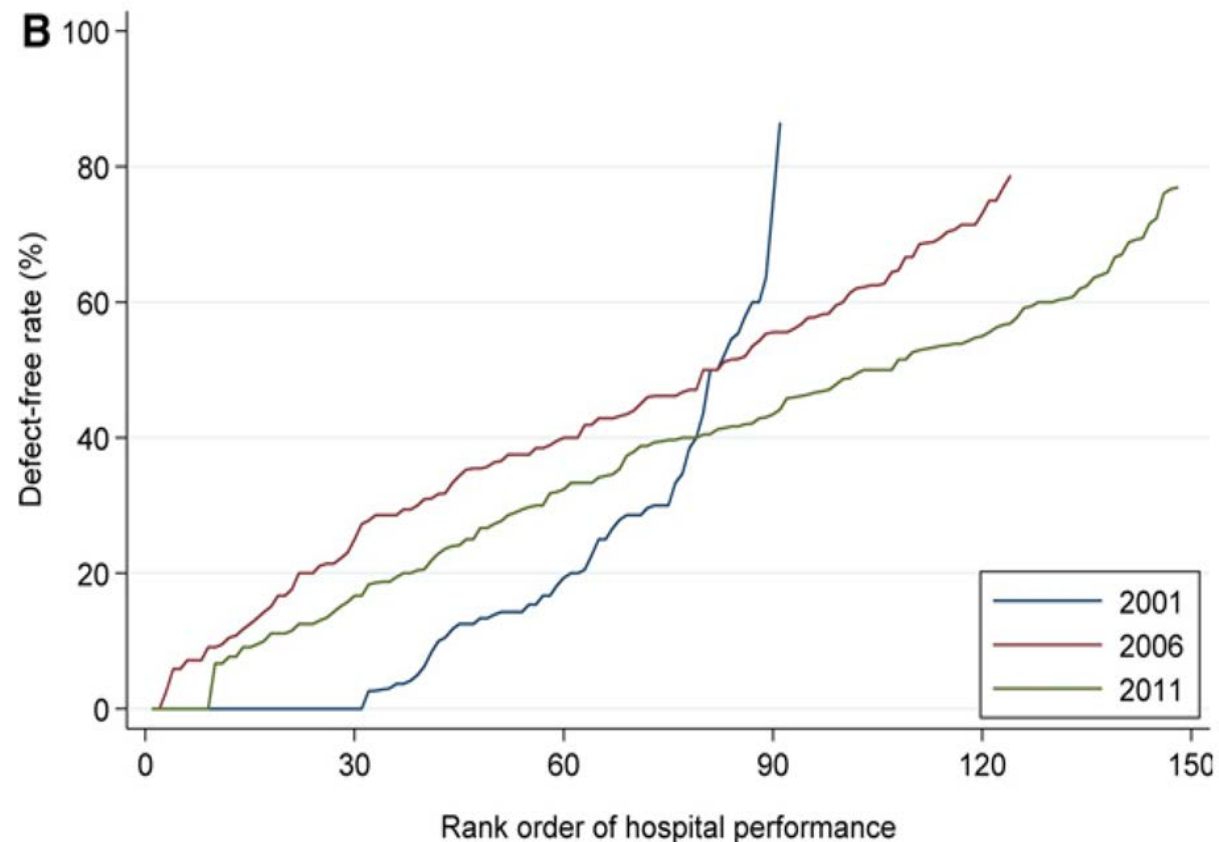
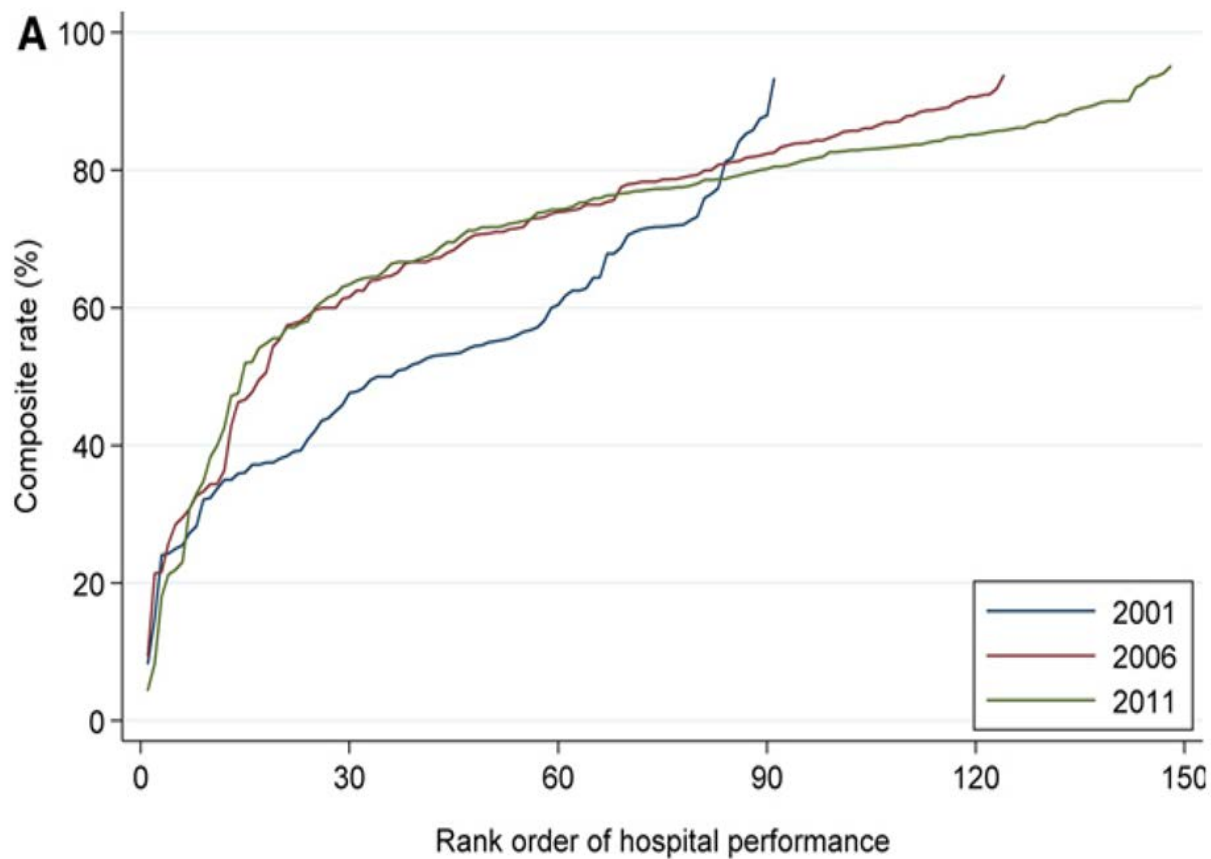
'01: 6.3 (4.4-8.4)  
'06: 5.7 (4.3-7.3)  
'11: 4.9 (3.8-6.2)

Rate  
% of ideal patients



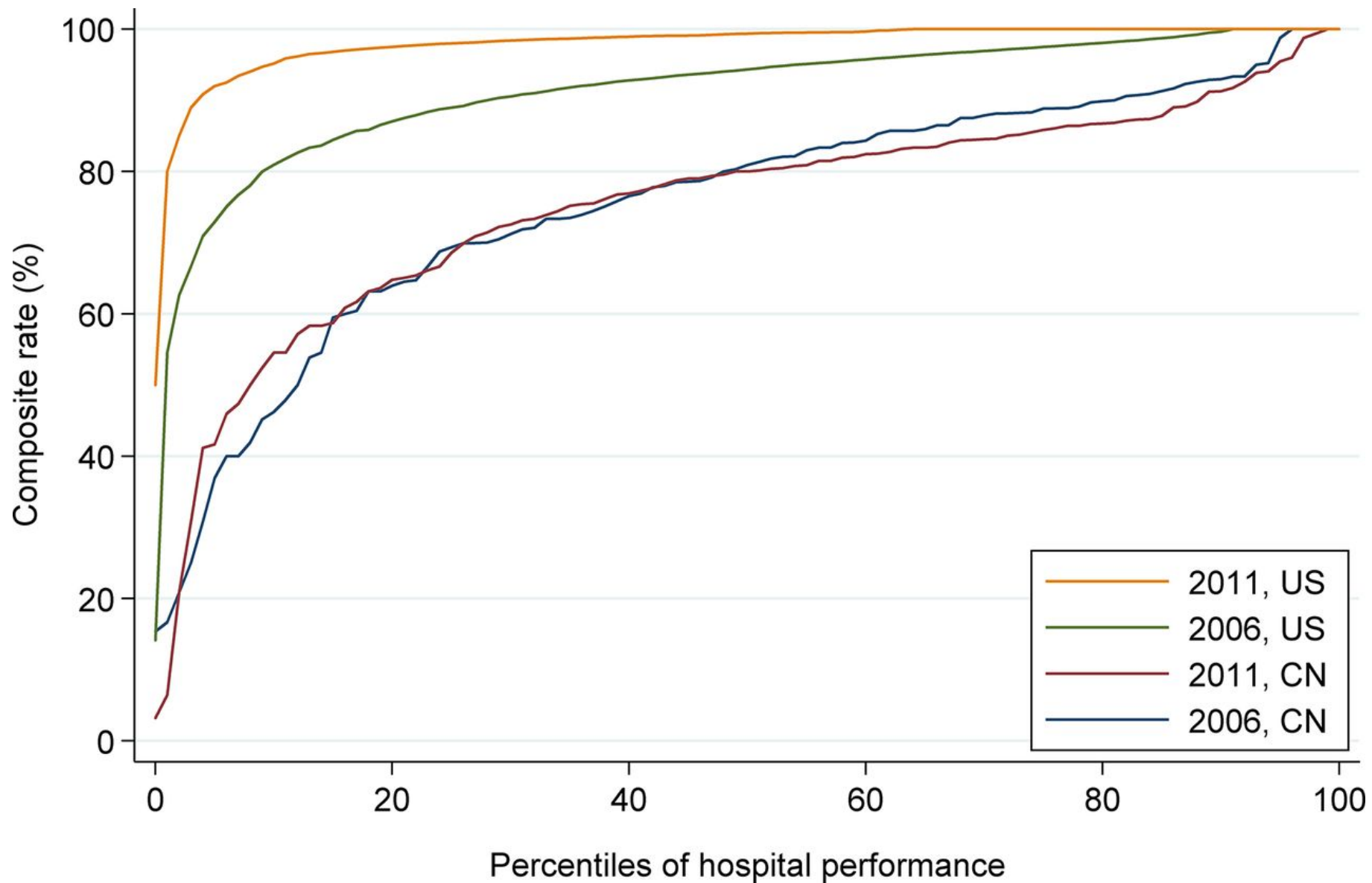
**Figure 1.** Variation (median odds ratio, median, and interquartile range) in rates of 6 process measures for ST-elevation myocardial infarction in 2001, 2006, and 2011.

ACEi indicates angiotensin converter enzyme inhibitor; ARB, angiotensin receptor blockers; n/a, not applicable.

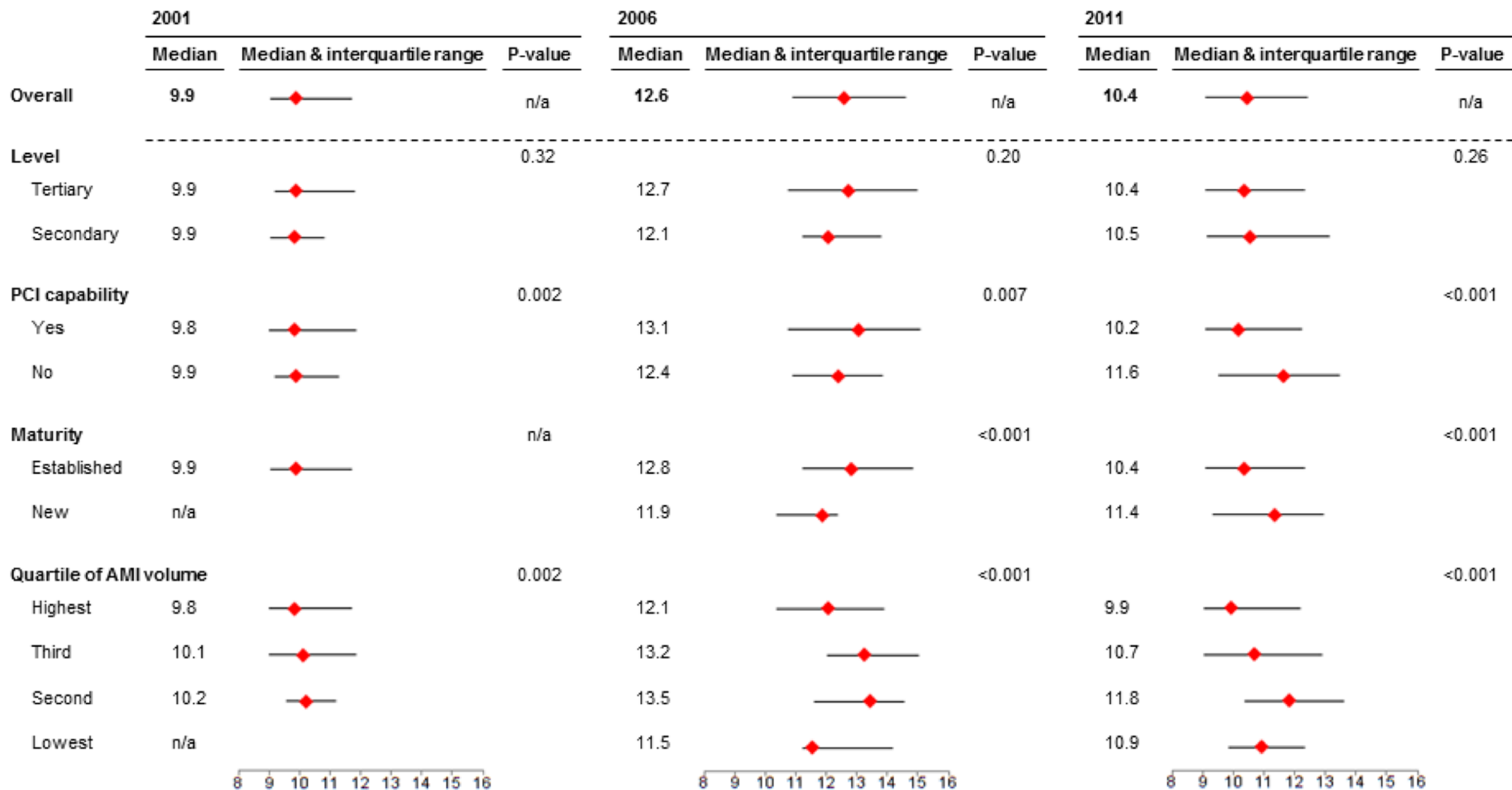


**Figure 2.** Distribution of composite (A) and defect-free (B) rates for ST-elevation myocardial infarction in 2001, 2006, and 2011.

\*\*The composite rate was calculated by dividing the number of times each hospital successfully delivered each of the guideline recommended care processes to an ideal patient by the total number of opportunities that the hospital had to deliver such interventions. The defect-free rate was defined as the proportion of patients at each hospital who received all treatments for which they were considered ideal.



**Figure 3.** Comparison of composite rate of aspirin, ACE inhibitor and beta-blocker therapy for patients with ST-elevation myocardial infarction treated in hospitals in China (CN) and the United States in 2006 and 2011. ACEi indicates angiotensin converter enzyme.



**Figure 4.** Risk-standardized mortality rates for ST-elevation myocardial infarction in 2001, 2006, and 2011, overall and stratified by hospital characteristics. AMI indicates acute myocardial infarction; n/a, not applicable; PCI, percutaneous coronary intervention.



## Conclusion

- This analysis of hospital performance using data from the nationally representative China PEACE-Retrospective AMI Study reveals substantial, but decreasing, variation between hospitals in quality of care provided to patients with STEMI, which means that patients are likely to be treated differently, and have different outcomes, depending on where they present for care.
- The persistent variation in the quality of care highlights an opportunity for China to improve the hospital quality by elevating all hospitals to level of performance that has been achieved by top-performing hospitals.