Original Article

Urban–Rural Comparisons in Hospital Admission, Treatments, and Outcomes for ST-Segment–Elevation Myocardial Infarction in China From 2001 to 2011 A Retrospective Analysis From the China PEACE Study (Patient-Centered Evaluative Assessment of Cardiac Events)

Xi Li, PhD; Karthik Murugiah, MD; Jing Li, PhD; Frederick A. Masoudi, MD; Paul S. Chan, MD; Shuang Hu, PhD; John A. Spertus, MD; Yongfei Wang, MS; Nicholas S. Downing, MD; Harlan M. Krumholz, MD*; Lixin Jiang, MD*; for the China PEACE Collaborative Group†

- *Background*—In response to urban–rural disparities in healthcare resources, China recently launched a healthcare reform with a focus on improving rural care during the past decade. However, nationally representative studies comparing medical care and patient outcomes between urban and rural areas in China during this period are not available.
- *Methods and Results*—We created a nationally representative sample of patients in China admitted for ST-segment–elevation myocardial infarction in 2001, 2006, and 2011, using a 2-stage random sampling design in 2 urban and 3 rural strata. In China, evidence-based treatments were provided less often in 2001 in rural hospitals, which had lower volume and less availability of advanced cardiac facilities. However, these differences diminished by 2011 for reperfusion therapy (54% in urban versus 57% in rural; *P*=0.1) and reversed for angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (66% versus 68%; *P*=0.04) and early β -blockers (56% versus 60%; *P*=0.01). The risk-adjusted rate of inhospital death or withdrawal from treatment was not significantly different between urban and rural hospitals in any study year, with an adjusted odds ratio of 1.13 (0.77–1.65) in 2001, 0.99 (0.77–1.27) in 2006, and 0.94 (0.74–1.19) in 2011.
- *Conclusions*—Although urban–rural disparities in evidence-based treatment for myocardial infarction in China have largely been eliminated, substantial gaps in quality of care persist in both settings. In addition, urban hospitals providing more resource-intensive care did not achieve better outcomes.
- Clinical Trial Registration—URL: https://www.clinicaltrials.gov. Unique identifier: NCT01624883. (Circ Cardiovasc Qual Outcomes. 2017;10:e003905. DOI: 10.1161/CIRCOUTCOMES.117.003905.)

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A Retrospective Analysis From the China PEACE Study (Patient-Centered Evaluative Assessment of Cardiac Events)

Xi Li, Karthik Murugiah, Jing Li, Frederick A. Masoudi, Paul S. Chan, Shuang Hu, John A. Spertus, Yongfei Wang, Nicholas S. Downing, Harlan M. Krumholz, Lixin Jiang, for the China PEACE Collaborative Group

Abstract

Background—In response to urban—rural disparities in healthcare resources, China recently launched a healthcare reform with a focus on improving rural care during the past decade. However, nationally representative studies comparing medical care and patient outcomes between urban and rural areas in China during this period are not available.

Methods and Results—We created a nationally representative sample of patients in China admitted for ST-segment–elevation myocardial infarction in 2001, 2006, and 2011, using a 2-stage random sampling design in 2 urban and 3 rural strata. In China, evidence-based treatments were provided less often in 2001 in rural hospitals, which had lower volume and less availability of advanced cardiac facilities. However, these differences diminished by 2011 for reperfusion therapy (54% in urban versus 57% in rural; P=0.1) and reversed for angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (66% versus 68%; P=0.04) and early β -blockers (56% versus 60%; P=0.01). The risk-adjusted rate of in-hospital death or withdrawal from treatment was not significantly different between urban and rural hospitals in any study year, with an adjusted odds ratio of 1.13 (0.77–1.65) in 2001, 0.99 (0.77–1.27) in 2006, and 0.94 (0.74–1.19) in 2011.

Conclusions—Although urban—rural disparities in evidence-based treatment for myocardial infarction in China have largely been eliminated, substantial gaps in quality of care persist in both settings. In addition, urban hospitals providing more resource-intensive care did not achieve better outcomes.

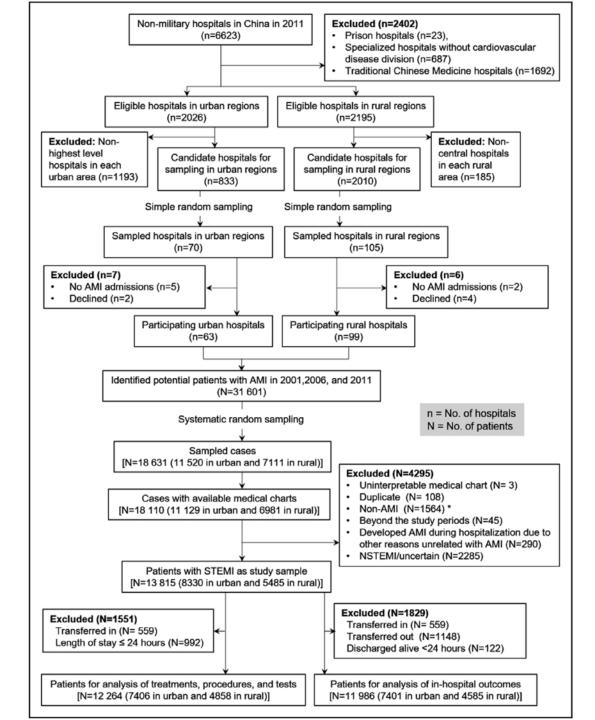


Figure 1. The 2-stage random sampling process in China PEACE (Patient-centered Evaluative Assessment of Cardiac Events), and the selection of the cohort for the present study. NSTEMI indicates non–ST-segment–elevation myocardial infarction; and STEMI, ST-segment–elevation myocardial infarction. *1564 cases were considered as non-acute myocardial infarction (AMI) because the duration from symptom onset to admission was >30 d.

Hospital Characteristics	Urban (n=63)	Rural (n=99)	<i>P</i> Value
Level of hospital			<0.001
Tertiary	58 (92%)	7 (7%)	
Secondary or lower	5 (8%)	92 (93%)	
Type of hospital			<0.001
Medical college affiliated	31 (49%)	9 (9%)	
Teaching, but not medical college affiliated	23 (37%)	30 (30%)	
Nonteaching	9 (14%)	60 (61%)	
Annual AMI inpatient volume*			
2001	27 (8–68)	5 (2–13)	<0.001
2006	70 (30–152)	15 (6–30)	<0.001
2011	148 (58–334)	34 (16–63)	<0.001
CCU in hospital in 2011	56 (89%)	38 (38%)	<0.001
Catheterization laboratory in hospital in 2011	55 (87%)	24 (24%)	<0.001
No. of qualified interventionists*	4 (3–6)	1 (0–3)	<0.001
Independent emergency department in 2011	60 (95%)	91(92%)	0.413
CABG capability in 2011	32 (51%)	1 (1%)	<0.001

Table 1. Characteristics of Urban and Rural Hospitals

AMI indicates acute myocardial infarction; CABG, coronary artery bypass graft; and CCU, coronary care unit.

*Median and interquartile range.

Table 2. Characteristics of Patients With ST-Segment–Elevation Myocardial Infarction

Demographics Age, y‡ 65 (56-72) 65 (55-72) 66 (55-73) 67 (56-74) 63 (53-73) 67 (58-76) V -60 428 (32%) 267 (34%) 0.89 (0.73-1.10) 810 (34%) 514 (32%) 1.10 (0.96-1.25) 1759 (33%) 927 (29%) 1.58 (1.43-1.74) <0.001 60-69 465 (35%) 216 (28%) 0.94 (0.75-1.17) 752 (32%) 592 (28%) 416 (28%) 0.91 (0.96-1.25) 1759 (33%) 917 (29%) 0.82 (0.74-0.90) 0.07 280 94 (7%) 57 (7%) 0.99 (0.88-1.44) 204 (9%) 152 (9%) 0.96 (0.84-1.11) 128 (28%) 948 (33%) 0.80 (0.72-0.88) 0.01 Cardiovascular risk factors Hypertension 590 (45%) 227 (166%) 1.45 (1.19-1.77) 1232 (54%) 662 (1.37-1.77) 2451 (54%) 149 (48%) 1.25 (1.14-1.37) 0.3 Upgetnesion 590 (45%) 2.276 (38%) 1.45 (1.19-1.77) 1232 (54%) 662 (43%) 1.56 (1.37-1.77) 2451 (54%) 1489 (48%) 1.25 (1.14-1.37) 0.3 Diabetes melitus 2.30 (17%) 2.2		2001				2006					
Ape, yi66 (56-72)66 (55-72)67 (50-73)67 (56-74)1063 (33-73)67 (58-76)1010 <th></th> <th>Urban* (n=1341)</th> <th>Rural* (n=786)</th> <th>OR (95% CI)†</th> <th></th> <th></th> <th>OR (95% CI)†</th> <th></th> <th>Rural* (n=3095)</th> <th>OR (95% CI)†</th> <th><i>P</i> for Interaction</th>		Urban* (n=1341)	Rural* (n=786)	OR (95% CI)†			OR (95% CI)†		Rural* (n=3095)	OR (95% CI)†	<i>P</i> for Interaction
<60 428 (32%) 267 (34%) 890 (73-1.0) 810 (34%) 514 (32%) 1.10 (0.96-1.28) 176 (39%) 927 (29%) 1.58 (1.4.7.4) 0.001 60-69 456 (53%) 246 (37%) 1.19 (0.97-1.46) 622 (28%) 1.64 (26%) 0.98 (0.83-1.10) 112 (42%) 811 (27%) 0.89 (0.74-0.3) 0.03 70-79 354 (26%) 0.94 (0.76*) 0.90 (0.82-1.12) 752 (32%) 1.58 (1.74) 0.42 (17%) 0.49 (0.76*) 0.00 Formale sex 392 (29%) 2.22 (29%) 1.02 (0.82-1.26) 679 (28%) 1.58 (1.37-1.77) 2451 (54*) 1.43 (1.4-1.70) 0.30 Cardiosactar risk factor 990 (45%) 2.24 (37%) 2.32 (1.68-3.10) 555 (55%) 192 (12%) 1.58 (1.37-1.77) 2451 (54*) 1.43 (1.40-1.40) 0.001 Dysighdmin 666 (65%) 2.24 (13%) 2.32 (1.68-3.10) 158 (1.79-1.77) 2451 (54*) 1.43 (1.40-1.40) 0.001 Outright factor 2.30 (1.76*) 2.44 (13%) 2.32 (1.68-3.10) 158 (1.67*) 1.58 (1.37-1.77) 2451 (54*) 1.43 (1.30-1.58)	Demographics		1								
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70-79 $354 (26%)$ $216 (28%)$ $0.94 (0.76-1.7)$ $752 (32%)$ $522 (32%)$ $0.98 (0.85-1.2)$ $1238 (28%)$ $915 (30%)$ $0.82 (0.74-0.9)$ 0.03 280 $94 (7%)$ $57 (7%)$ $0.99 (0.68-1.4)$ $204 (9%)$ $152 (9%)$ $0.92 (0.74-1.15)$ $470 (10%)$ $442 (14%)$ $0.64 (0.56-0.7)$ 0.003 Female sex $332 (29%)$ $222 (29%)$ $102 (0.82-1.6)$ $679 (28%)$ $458 (29%)$ $0.92 (0.74-1.15)$ $247 (10%)$ $442 (14%)$ $0.64 (0.56-0.7)$ 0.003 Tormations $222 (29%)$ $120 (0.82-1.6)$ $679 (28%)$ $458 (29%)$ $0.92 (0.74-1.15)$ $245 (35%)$ $0.94 (0.38)$ $0.80 (0.7-1.7)$ $0.23 (28%)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.94 (0.38)$ $0.80 (0.7-1.15)$ $0.92 (0.7-1.15)$ $0.92 (0.7-1.15)$ $0.92 (0.7-1.15)$ $0.92 (0.7-2.15)$ $0.92 (0.7-2.15)$ $0.92 (0.7-2.15)$ $0.92 (0.7-2.15)$ $0.92 (0.7-2.15)$ $0.92 (0.7-2.15)$ $0.92 (0.7-2.15)$ $0.81 (0.5) (0.5) (0.5)$ $0.76 (0.5%)$ $0.76 (0.5%)$ <	<60	428 (32%)	267 (34%)	0.89 (0.73–1.10)	810 (34%)	514 (32%)	1.10 (0.96–1.25)	1769 (39%)	927 (29%)	1.58 (1.43–1.74)	<0.001
280 94 (?%) 57 (?%) 0.99 (0.68-1.4) 204 (9%) 152 (9%) 0.92 (0.74-1.15) 470 (10%) 442 (14%) 0.64 (0.56-0.73) 0.003 Fenales ex 392 (29%) 222 (29%) 1.02 (0.82-1.26) 679 (28%) 458 (29%) 0.96 (0.84-1.11) 1263 (28%) 984 (33%) 0.60 (0.72-0.83) 0.001 Cardioaccian field factors U U U 0.86 (0.84-1.11) 1263 (28%) 1439 (49%) 126 (1.14-1.37) 0.001 Diablets mellitus 200 (17%) 66 (6%) 1.45 (1.19-1.77) 1232 (54%) 66 (62 (43%) 1.56 (1.37-1.71) 2451 (54%) 1439 (49%) 1.60 (1.42-1.80) 0.001 Diablets mellitus 200 (7%) 66 (6%) 2.21 (1.89-1.38) 1392 (57%) 772 (49%) 1.35 (1.19-1.54) 3004 (68%) 1389 (45%) 1.56 (1.47-1.70) 0.20 Out risk factors 169 (13%) 2.46 (1.71-3.55) 466 (22%) 190 (13%) 1.81 (1.52-2.16) 1126 (26%) 466 (17%) 1.76 (1.57-1.7) 0.20 2 438 (34%) 171 (22%) 1.83 (1.47-2.29 <th< td=""><td>60–69</td><td>465 (35%)</td><td>246 (31%)</td><td>1.19 (0.97–1.46)</td><td>622 (26%)</td><td>416 (26%)</td><td>0.95 (0.83–1.10)</td><td>1124 (25%)</td><td>811 (27%)</td><td>0.93 (0.83-1.03)</td><td>0.05</td></th<>	60–69	465 (35%)	246 (31%)	1.19 (0.97–1.46)	622 (26%)	416 (26%)	0.95 (0.83–1.10)	1124 (25%)	811 (27%)	0.93 (0.83-1.03)	0.05
Ferrale sex 392 (29%) 1.02 (0.82-1.6) 679 (28%) 4.58 (29%) 0.96 (0.4-1.1) 126 (28%) 984 (33%) 0.80 (0.72-0.8) Cardioxular isk factors	70–79	354 (26%)	216 (28%)	0.94 (0.76–1.17)	752 (32%)	522 (32%)	0.98 (0.85–1.12)	1238 (26%)	915 (30%)	0.82 (0.74-0.90)	0.07
Cardiovascular risk factors S90 (45%) 276 (36%) 1.45 (1.19–1.77) 1232 (54%) 662 (43%) 1.56 (1.37–1.77) 2451 (54%) 1439 (48%) 1.25 (1.14–1.37) 0.3 Diabetes mellitus 230 (17%) 66 (6%) 2.27 (1.66–3.10) 555 (25%) 192 (12%) 2.50 (2.09–2.99) 1078 (24%) 480 (16%) 1.60 (1.42–1.80) <0.001	≥80	94 (7%)	57 (7%)	0.99 (0.68–1.44)	204 (9%)	152 (9%)	0.92 (0.74–1.15)	470 (10%)	442 (14%)	0.64 (0.56-0.73)	0.003
Hypertension 590 (45%) 276 (36%) 1.45 (1.19-1.77) 1232 (54%) 662 (43%) 1.56 (1.37-1.77) 2451 (54%) 1439 (48%) 1.25 (1.14-1.37) 0.3 Diabetes mellitus 230 (17%) 666 (3%) 2.27 (1.66-3.10) 555 (25%) 192 (12%) 2.50 (2.09-2.99) 1078 (24%) 480 (16%) 160 (1.42-1.80) 0.001 Dysipidemia 664 (62%) 244 (31%) 2.32 (1.89-2.84) 1329 (57%) 772 (49%) 1.35 (1.19-1.54) 3004 (68%) 1839 (59%) 1.43 (1.30-1.58) 0.004 Current smoker 408 (32%) 221 (28%) 1.61 (0.94-1.44) 807 1.08 (0.94-1.23) 1889 (43%) 965 (33%) 1.54 (1.40-1.58) 0.004 No. of risk factors -	Female sex	392 (29%)	222 (29%)	1.02 (0.82–1.26)	679 (28%)	458 (29%)	0.96 (0.84–1.11)	1263 (28%)	984 (33%)	0.80 (0.72-0.88)	0.01
Diabetes mellitus 230 (17%) 66 (6%) 2.27 (1.66-3.10) 555 (25%) 192 (12%) 2.50 (2.0-92.8) 1078 (24%) 480 (16%) 160 (1.42-1.80) <.0.001 Dyslpidemia 664 (62%) 244 (31%) 2.32 (1.89-2.84) 1329 (57%) 772 (49%) 1.35 (1.19-1.54) 3004 (68%) 1839 (59%) 1.54 (1.40-1.70) <.0.01	Cardiovascular risk factors										
Dyslipidemia 666 (52%) 244 (31%) 2.32 (1.89-2.84) 1329 (57%) 772 (49%) 1.35 (1.19-1.54) 3004 (68%) 1839 (59%) 1.43 (1.30-1.58) 0.001 Current smoker 408 (32%) 221 (28%) 1.16 (0.94-1.44) 807 (36%) 499 (34%) 1.08 (0.94-1.23) 1889 (43%) 965 (33%) 1.54 (1.40-1.70) <0.01	Hypertension	590 (45%)	276 (36%)	1.45 (1.19–1.77)	1232 (54%)	662 (43%)	1.56 (1.37–1.77)	2451 (54%)	1439 (48%)	1.25 (1.14–1.37)	0.3
Current smoker408 (32%)221 (28%)1.16 (0.94-1.4)807 (36%)499 (34%)1.08 (0.94-1.23)188 (43%)965 (33%)1.54 (1.40-1.70)<.001No. of risk factors11 </td <td>Diabetes mellitus</td> <td>230 (17%)</td> <td>66 (8%)</td> <td>2.27 (1.66–3.10)</td> <td>555 (25%)</td> <td>192 (12%)</td> <td>2.50 (2.09–2.99)</td> <td>1078 (24%)</td> <td>480 (16%)</td> <td>1.60 (1.42-1.80)</td> <td><0.001</td>	Diabetes mellitus	230 (17%)	66 (8%)	2.27 (1.66–3.10)	555 (25%)	192 (12%)	2.50 (2.09–2.99)	1078 (24%)	480 (16%)	1.60 (1.42-1.80)	<0.001
No. of risk factors Image: Constraint of the state of t	Dyslipidemia	664 (52%)	244 (31%)	2.32 (1.89–2.84)	1329 (57%)	772 (49%)	1.35 (1.19–1.54)	3004 (68%)	1839 (59%)	1.43 (1.30–1.58)	0.004
≥3169 (13%)45 (6%)2.46 (1.71-3.5)468 (22%)190 (13%)1.81 (1.52-2.6)1126 (26%)488 (17%)1.76 (1.57-1.97)0.22438 (34%)171 (22%)1.83 (1.47-2.29)849 (36%)459 (29%)1.38 (1.20-1.58)1807 (40%)1071 (35%)1.27 (1.15-1.39)0.001496 (36%)326 (42%)0.79 (0.55-0.68)767 (30%)623 (38%)0.72 (0.63-0.82)1289 (26%)1068 (35%)0.66 (0.60-0.73)0.69None238 (17%)244 (31%)0.46 (0.36-0.58)304 (11%)332 (19%)0.53 (0.44-0.63)379 (7%)470 (14%)0.50 (0.43-0.59)0.77Mocardial infarction154 (11%)64 (9%)1.37 (0.99-1.90)226 (10%)1.48 (10%)1.06 (0.86-1.31)539 (12%)275 (9%)1.37 (1.18-1.59)0.4Conary heard isease357 (27%)146 (19%)1.52 (1.21-1.39)486 (21%)304 (19%)1.11 (0.95-1.30)977 (22%)591 (19%)1.17 (1.04-1.31)0.1PCI8 (1%)6 (1%)0.77 (0.27-2.24)28 (1%)1.23 (0.40-3.7)14.0(%)1.46 (19%)1.26 (12%)335 (12%)1.96 (0.92-1.21)0.60Storke126 (9%)71 (1%)0.29 (0.08-1.15)26 (12%)135 (1.0-6)14.0(%)1.46 (19%)1.96 (0.22)0.6Chicat thistor126 (9%)71 (1%)0.29 (0.08-1.16)26 (1%)1.23 (0.40-3.7)14.0(%)1.40 (19%)1.21 (1.1.41, 13)0.1Storke126 (9%)71 (1%)0.97 (0.27-2.4)26 (1%) <td< td=""><td>Current smoker</td><td>408 (32%)</td><td>221 (28%)</td><td>1.16 (0.94–1.44)</td><td>807 (36%)</td><td>499 (34%)</td><td>1.08 (0.94–1.23)</td><td>1889 (43%)</td><td>965 (33%)</td><td>1.54 (1.40–1.70)</td><td><0.001</td></td<>	Current smoker	408 (32%)	221 (28%)	1.16 (0.94–1.44)	807 (36%)	499 (34%)	1.08 (0.94–1.23)	1889 (43%)	965 (33%)	1.54 (1.40–1.70)	<0.001
2438 (34%)171 (22%)1.83 (1.47-2.29)849 (36%)459 (29%)1.38 (1.20-1.58)1807 (40%)1071 (35%)1.27 (1.15-1.9)0.0061496 (36%)326 (42%)0.79 (0.65-0.96)767 (30%)623 (38%)0.72 (0.63-0.82)1289 (26%)1068 (35%)0.66 (0.60-0.73)0.09None238 (17%)244 (31%)0.46 (0.36-0.58)304 (11%)332 (19%)0.53 (0.44-0.63)379 (7%)470 (14%)0.50 (0.43-0.59)0.7Medical history154 (11%)64 (9%)1.37 (0.99-1.90)226 (10%)148 (10%)1.06 (0.86-1.31)539 (12%)275 (9%)1.37 (1.18-1.59)0.4Coronary heart disease357 (27%)146 (19%)1.52 (1.21-1.93)486 (21%)304 (19%)1.11 (0.95-1.30)977 (22%)591 (19%)1.17 (1.04-1.31)0.1PCI8 (1%)6 (1%)0.77 (0.27-2.24)28 (1%)12 (1%)1.25 (0.68-2.31)134 (3%)46 (2%)1.91 (1.39-2.63)0.66CABG3 (0%)7 (1%)0.92 (0.87-1.51)276 (12%)1.35 (1.10-1.67)562 (12%)335 (12%)1.06 (0.92-1.22)0.66CInical characteristicsSymptom onset to admission, h‡\$15 (3-72)14 (3-72)Q2 (4-72)10 (3-48)Q2 (4-96)8 (3-48) $[C - 12, 1, 23, 1$	No. of risk factors										
1496 (36%)326 (42%)0.79 (0.65-0.96)767 (30%)623 (38%)0.72 (0.63-0.82)1289 (26%)1068 (35%)0.66 (0.60-0.73)0.09None238 (17%)244 (31%)0.46 (0.36-0.58)304 (11%)332 (19%)0.53 (0.44-0.63)379 (7%)470 (14%)0.50 (0.43-0.59)0.7Modical historyWeiclal historyWeicla history154 (11%)64 (9%)1.37 (0.99-1.90)226 (10%)148 (10%)1.06 (0.86-1.31)539 (12%)275 (9%)1.37 (1.18-1.59)0.4Coronary heart disease357 (27%)146 (19%)1.52 (1.21-1.93)486 (21%)304 (19%)1.11 (0.95-1.30)977 (22%)591 (19%)1.17 (1.04-1.31)0.1PCI8 (1%)6 (1%)0.77 (0.27-2.24)28 (1%)12 (1%)1.25 (0.68-2.31)134 (3%)46 (2%)1.91 (1.39-2.63)0.60CABG3 0%)7 (1%)0.29 (0.81-1.05)6 (0%)3 (0%)1.23 (0.40-3.74)14 (0%)7 (0%)0.93 (0.37-2.34)0.1Clinical characteristics977 (20%)126 (9%)72 (10%)0.97 (0.70-1.34)276 (12%)135 (1.01-1.67)562 (12%)335 (12%)1.06 (0.92-1.22)0.66Symptom onset to admission, h‡15 (3-72)14 (3-72)0.94 (0.75-1.17)436 (17%)348 (23%)0.70 (0.60-0.83)767 (16%)8 (3-48)(E1 < 1.20 (0.11-16))0.03Symptom onset to admission, h‡15 (3-72)14 (3-72)0.94 (0.75-1.17)436 (17%)348 (23%)0.70 (0.60-0.83)767 (16%)8 (3-48)(E1 < 1	≥3	169 (13%)	45 (6%)	2.46 (1.71-3.55)	468 (22%)	190 (13%)	1.81 (1.52–2.16)	1126 (26%)	486 (17%)	1.76 (1.57–1.97)	0.2
None238 (17%)244 (31%)0.46 (0.36-0.58)304 (11%)332 (19%)0.53 (0.44-0.63)379 (7%)470 (14%)0.50 (0.43-0.59)0.7Medical historyMyocardial infarction154 (11%)64 (9%)1.37 (0.99-1.90)226 (10%)148 (10%)1.06 (0.86-1.31)539 (12%)275 (9%)1.37 (1.18-1.59)0.4Coronary heart disease357 (27%)146 (19%)1.52 (1.21-1.93)486 (21%)304 (19%)1.11 (0.95-1.30)977 (22%)591 (19%)1.17 (1.04-1.31)0.1PCI8 (1%)6 (1%)0.77 (0.27-2.24)28 (1%)12 (1%)1.25 (0.68-2.31)134 (3%)46 (2%)1.91 (1.39-2.63)0.06CABG3 (0%)7 (1%)0.29 (0.08-1.05)6 (0%)3 (0%)1.23 (0.40-3.74)14 (0%)7 (0%)0.93 (0.37-2.34)0.2Stroke126 (9%)72 (10%)0.97 (0.70-1.34)276 (12%)135 (1.10-1.67)562 (12%)335 (12%)1.06 (0.92-1.22)0.68Clinical characteristicsSymptom onset to admission, h‡\$15 (3-72)14 (3-72)23 (4-72)10 (3-48)20 (4-96)8 (3-48)<3	2	438 (34%)	171 (22%)	1.83 (1.47–2.29)	849 (36%)	459 (29%)	1.38 (1.20–1.58)	1807 (40%)	1071 (35%)	1.27 (1.15–1.39)	0.006
Medical history Myocardial infarction 154 (11%) 64 (9%) 1.37 (0.99–1.90) 226 (10%) 148 (10%) 1.06 (0.86–1.31) 539 (12%) 275 (9%) 1.37 (1.18–1.59) 0.4 Coronary heart disease 357 (27%) 146 (19%) 1.52 (1.21–1.93) 486 (21%) 304 (19%) 1.11 (0.95–1.30) 977 (22%) 591 (19%) 1.17 (1.04–1.31) 0.1 PCI 8 (1%) 6 (1%) 0.77 (0.27–2.24) 28 (1%) 12 (1%) 1.25 (0.68–2.31) 134 (3%) 46 (2%) 1.91 (1.39–2.63) 0.06 CABG 3 (0%) 7 (1%) 0.29 (0.08–1.05) 6 (0%) 3 (0%) 1.23 (0.40–3.74) 14 (0%) 7 (0%) 0.93 (0.37–2.34) 0.2 Stroke 126 (9%) 72 (10%) 0.97 (0.70–1.34) 276 (12%) 1.35 (1.10–1.67) 562 (12%) 335 (12%) 1.06 (0.92–1.22) 0.6 Clinical characteristics 539 (19%) 152 (20%) 0.94 (0.75–1.17) 436 (17%) 348 (23%) 0.70 (0.60–0.83) 767 (16%) 712 (23%) 0.63 (0.56–0.71) 0.003 <3 10	1	496 (36%)	326 (42%)	0.79 (0.65–0.96)	767 (30%)	623 (38%)	0.72 (0.63–0.82)	1289 (26%)	1068 (35%)	0.66 (0.60-0.73)	0.09
Myocardial infarction154 (11%)64 (9%)1.37 (0.99-1.90)226 (10%)148 (10%)1.06 (0.86-1.31)539 (12%)275 (9%)1.37 (1.18-1.59)0.4Coronary heart disease357 (27%)146 (19%)1.52 (1.21-1.93)486 (21%)304 (19%)1.11 (0.95-1.30)977 (22%)591 (19%)1.17 (1.04-1.31)0.1PCI8 (1%)6 (1%)0.77 (0.27-2.24)28 (1%)12 (1%)1.25 (0.68-2.31)134 (3%)46 (2%)1.91 (1.39-2.63)0.06CABG3 (0%)7 (1%)0.29 (0.08-1.05)6 (0%)3 (0%)1.23 (0.40-3.74)14 (0%)7 (0%)0.93 (0.37-2.34)0.2Stroke126 (9%)72 (10%)0.97 (0.70-1.34)276 (12%)145 (9%)1.35 (1.10-1.67)562 (12%)335 (12%)1.06 (0.92-1.22)0.6Clinical characteristicsSymptom onset to admission, h‡§15 (3-72)14 (3-72)23 (4-72)10 (3-48)20 (4-96)8 (3-48)Image: Constant of the constant of	None	238 (17%)	244 (31%)	0.46 (0.36-0.58)	304 (11%)	332 (19%)	0.53 (0.44–0.63)	379 (7%)	470 (14%)	0.50 (0.43-0.59)	0.7
Coronary heart disease357 (27%)146 (19%)1.52 (1.21–1.93)486 (21%)304 (19%)1.11 (0.95–1.30)977 (22%)591 (19%)1.17 (1.04–1.31)0.1PCI8 (1%)6 (1%)0.77 (0.27–2.24)28 (1%)12 (1%)1.25 (0.68–2.31)134 (3%)46 (2%)1.91 (1.39–2.63)0.06CABG3 (0%)7 (1%)0.29 (0.08–1.05)6 (0%)3 (0%)1.23 (0.40–3.74)14 (0%)7 (0%)0.93 (0.37–2.34)0.2Stroke126 (9%)72 (10%)0.97 (0.70–1.34)276 (12%)145 (9%)1.35 (1.10–1.67)562 (12%)335 (12%)1.06 (0.92–1.22)0.6Clinical characteristicsSymptom onset to admission, h‡§15 (3–72)14 (3–72)23 (4–72)10 (3–48)20 (4–96)8 (3–48)Image: Constrained constra	Medical history										
PCI8 (1%)6 (1%)0.77 (0.27–2.24)28 (1%)12 (1%)1.25 (0.68–2.31)134 (3%)46 (2%)1.91 (1.39–2.63)0.06CABG3 (0%)7 (1%)0.29 (0.08–1.05)6 (0%)3 (0%)1.23 (0.40–3.74)14 (0%)7 (0%)0.93 (0.37–2.34)0.2Stroke126 (9%)72 (10%)0.97 (0.70–1.34)276 (12%)145 (9%)1.35 (1.10–1.67)562 (12%)335 (12%)1.06 (0.92–1.22)0.6Clinical characteristicsSymptom onset to admission, h‡§15 (3–72)14 (3–72)23 (4–72)10 (3–48)20 (4–96)8 (3–48)<3	Myocardial infarction	154 (11%)	64 (9%)	1.37 (0.99–1.90)	226 (10%)	148 (10%)	1.06 (0.86–1.31)	539 (12%)	275 (9%)	1.37 (1.18–1.59)	0.4
CABG3 (0%)7 (1%)0.29 (0.08–1.05)6 (0%)3 (0%)1.23 (0.40–3.74)14 (0%)7 (0%)0.93 (0.37–2.34)0.2Stroke126 (9%)72 (10%)0.97 (0.70–1.34)276 (12%)145 (9%)1.35 (1.10–1.67)562 (12%)335 (12%)1.06 (0.92–1.22)0.6Clinical characteristicsSymptom onset to admission, h‡§15 (3–72)14 (3–72)23 (4–72)10 (3–48)20 (4–96)8 (3–48)< 3253 (19%)152 (20%)0.94 (0.75–1.17)436 (17%)348 (23%)0.70 (0.60–0.83)767 (16%)712 (23%)0.63 (0.56–0.71)0.0033 to <6232 (18%)115 (14%)1.29 (1.01–1.65)342 (15%)276 (17%)0.83 (0.69–0.99)691 (16%)560 (19%)0.82 (0.72–0.93)0.0066 to <12130 (10%)88 (11%)0.89 (0.66–1.19)281 (13%)185 (12%)1.03 (0.84–1.26)517 (12%)377 (12%)1.00 (0.86–1.16)0.6	Coronary heart disease	357 (27%)	146 (19%)	1.52 (1.21–1.93)	486 (21%)	304 (19%)	1.11 (0.95–1.30)	977 (22%)	591 (19%)	1.17 (1.04–1.31)	0.1
Stroke 126 (9%) 72 (10%) 0.97 (0.70–1.34) 276 (12%) 145 (9%) 1.35 (1.10–1.67) 562 (12%) 335 (12%) 1.06 (0.92–1.22) 0.6 Clinical characteristics Symptom onset to admission, h‡§ 15 (3–72) 14 (3–72) 23 (4–72) 10 (3–48) 20 (4–96) 8 (3–48) <3 253 (19%) 152 (20%) 0.94 (0.75–1.17) 436 (17%) 348 (23%) 0.70 (0.60–0.83) 767 (16%) 712 (23%) 0.63 (0.56–0.71) 0.003 3 to <6 232 (18%) 115 (14%) 1.29 (1.01–1.65) 342 (15%) 276 (17%) 0.83 (0.69–0.99) 691 (16%) 560 (19%) 0.82 (0.72–0.93) 0.006 6 to <12 130 (10%) 88 (11%) 0.89 (0.66–1.19) 281 (13%) 185 (12%) 1.03 (0.84–1.26) 517 (12%) 377 (12%) 1.00 (0.86–1.16) 0.6	PCI	8 (1%)	6 (1%)	0.77 (0.27-2.24)	28 (1%)	12 (1%)	1.25 (0.68–2.31)	134 (3%)	46 (2%)	1.91 (1.39–2.63)	0.06
Clinical characteristics Symptom onset to admission, h‡§ 15 (3–72) 14 (3–72) 23 (4–72) 10 (3–48) 20 (4–96) 8 (3–48) (3–48) <3	CABG	3 (0%)	7 (1%)	0.29 (0.08–1.05)	6 (0%)	3 (0%)	1.23 (0.40–3.74)	14 (0%)	7 (0%)	0.93 (0.37-2.34)	0.2
Symptom onset to admission, h‡§ 15 (3-72) 14 (3-72) 23 (4-72) 10 (3-48) 20 (4-96) 8 (3-48) Control Contro Control Contro	Stroke	126 (9%)	72 (10%)	0.97 (0.70–1.34)	276 (12%)	145 (9%)	1.35 (1.10–1.67)	562 (12%)	335 (12%)	1.06 (0.92-1.22)	0.6
<3 253 (19%) 152 (20%) 0.94 (0.75–1.17) 436 (17%) 348 (23%) 0.70 (0.60–0.83) 767 (16%) 712 (23%) 0.63 (0.56–0.71) 0.003 3 to <6	Clinical characteristics										
3 to <6 232 (18%) 115 (14%) 1.29 (1.01–1.65) 342 (15%) 276 (17%) 0.83 (0.69–0.99) 691 (16%) 560 (19%) 0.82 (0.72–0.93) 0.006 6 to <12	Symptom onset to admission, h‡§	15 (3–72)	14 (3–72)		23 (4–72)	10 (3–48)		20 (4–96)	8 (3–48)		
6 to <12 130 (10%) 88 (11%) 0.89 (0.66-1.19) 281 (13%) 185 (12%) 1.03 (0.84-1.26) 517 (12%) 377 (12%) 1.00 (0.86-1.16) 0.6	<3	253 (19%)	152 (20%)	0.94 (0.75–1.17)	436 (17%)	348 (23%)	0.70 (0.60–0.83)	767 (16%)	712 (23%)	0.63 (0.56-0.71)	0.003
	3 to <6	232 (18%)	115 (14%)	1.29 (1.01–1.65)	342 (15%)	276 (17%)	0.83 (0.69–0.99)	691 (16%)	560 (19%)	0.82 (0.72-0.93)	0.006
12 to <24 100 (8%) 73 (9%) 0.85 (0.62-1.17) 145 (6%) 131 (8%) 0.75 (0.58-0.97) 341 (8%) 220 (7%) 1.05 (0.87-1.27) 0.1	6 to <12	130 (10%)	88 (11%)	0.89 (0.66–1.19)	281 (13%)	185 (12%)	1.03 (0.84–1.26)	517 (12%)	377 (12%)	1.00 (0.86-1.16)	0.6
	12 to <24	100 (8%)	73 (9%)	0.85 (0.62–1.17)	145 (6%)	131 (8%)	0.75 (0.58–0.97)	341 (8%)	220 (7%)	1.05 (0.87-1.27)	0.1

oronary artery ypass grafting; CI, onfidence interval; GFR, estimated omerular filtration te; GRACE, Global egistry of Acute oronary Events; R, odds ratio; and CI, percutaneous oronary tervention. Category variables splayed as umber (weighed ercentage). With patients in ural hospital as the eference group. Median nterquartile ange). Excluding patients ho were ansferred in. Among patients ith the easurement.

Table 2. Continued

	2001				2006					
	Urban* (n=1341)	Rural* (n=786)	0R (95% Cl)†	Urban* (n=2388)	Rural* (n=1604)	0R (95% Cl)†	Urban* (n=4601)	Rural* (n=3095)	0R (95% CI)†	<i>P</i> for Interaction
≥24	599 (45%)	348 (45%)	1.00 (0.83–1.19)	1093 (49%)	652 (40%)	1.48 (1.29–1.69)	1932 (48%)	1160 (38%)	1.49 (1.35–1.65)	0.001
Chest discomfort	1244 (93%)	726 (93%)	1.09 (0.75–1.58)	2216 (93%)	1464 (92%)	1.28 (1.01–1.63)	4275 (93%)	2843 (92%)	1.23 (1.04–1.47)	0.7
Cardiac arrest	17 (1%)	4 (0%)	2.71 (0.77–9.57)	39 (2%)	10 (1%)	2.88 (1.48–5.59)	88 (2%)	37 (1%)	1.26 (0.88–1.81)	0.04
Cardiogenic shock	53 (4%)	41 (5%)	0.74 (0.47–1.16)	136 (5%)	109 (7%)	0.74 (0.57–0.96)	293 (6%)	215 (7%)	0.91 (0.75–1.09)	0.2
Acute stroke	13 (1%)	5 (1%)	1.43 (0.46–4.43)	39 (2%)	30 (2%)	0.98 (0.60–1.59)	49 (1%)	34 (1%)	0.78 (0.49–1.24)	0.3
Heart rate, bpm‡	78 (66–90)	80 (67–90)		78 (68–90)	78 (64–90)		76 (65–88)	77 (64–90)		
<50	73 (5%)	36 (5%)	1.17 (0.75–1.81)	131 (5%)	90 (5%)	0.92 (0.69–1.22)	201 (4%)	183 (7%)	0.58 (0.47–0.71)	0.001
50–110	1190 (89%)	698 (89%)	0.97 (0.71–1.31)	2099 (89%)	1395 (87%)	1.15 (0.95–1.40)	4188 (92%)	2729 (88%)	1.57 (1.35–1.82)	0.001
>110	78 (6%)	52 (6%)	0.93 (0.63–1.39)	158 (6%)	119 (8%)	0.85 (0.66–1.08)	212 (4%)	183 (6%)	0.74 (0.60–0.91)	0.2
Systolic blood pressure, mm Hg‡	120 (105–140)	128 (105–145)		125 (110–142)	124 (109–143)		127 (110–144)	129 (110–145)		
<90	87 (6%)	67 (8%)	0.73 (0.50–1.05)	132 (5%)	132 (8%)	0.58 (0.45–0.75)	216 (4%)	192 (5%)	0.81 (0.65–1.00)	0.3
90–139	836 (63%)	445 (56%)	1.31 (1.08–1.59)	1473 (63%)	926 (57%)	1.25 (1.10–1.42)	2855 (63%)	1803 (57%)	1.26 (1.15–1.39)	0.8
≥140	418 (31%)	274 (36%)	0.82 (0.67-1.01)	783 (33%)	546 (35%)	0.91 (0.80–1.04)	1530 (33%)	1100 (37%)	0.82 (0.74–0.90)	0.6
eGFR‡¶	73 (57–92)	71 (54–88)		76 (58–97)	73 (56–91)		86 (66–108)	82 (62–104)		
Unmeasured	401 (27)	432 (54)	0.32 (0.26–0.39)	344 (12%)	452 (25%)	0.41 (0.35–0.48)	275 (5%)	343 (10%)	0.49 (0.41–0.58)	0.01
<30	41 (3%)	26 (3%)	0.97 (0.56-1.65)	98 (4%)	42 (3%)	1.55 (1.08–2.25)	139 (3%)	93 (3%)	1.11 (0.85–1.46)	0.8
30–59	223 (17%)	94 (12%)	1.49 (1.13–1.96)	452 (18%)	304 (18%)	1.01 (0.86–1.19)	733 (15%)	530 (16%)	0.93 (0.82–1.05)	0.007
≥60	676 (52%)	234 (30%)	2.50 (2.04-3.07)	1494 (65%)	806 (54%)	1.62 (1.43–1.85)	3454 (76%)	2129 (71%)	1.33 (1.20–1.48)	<0.001
Ejection fraction‡¶	54 (44–62)	55 (44–64)		53 (44–60)	53 (42–62)		55 (46–61)	55 (46–62)		
Unmeasured	1021 (74)	680 (86)	0.45 (0.35–0.58)	1085 (50)	1212 (72)	0.38 (0.33–0.44)	1562 (30)	1813 (55)	0.35 (0.32–0.38)	0.03
<40%	38 (3%)	20 (3%)	1.25 (0.70–2.23)	176 (8%)	69 (4%)	1.86 (1.39–2.48)	295 (7%)	146 (5%)	1.46 (1.19–1.80)	0.7
≥40%	282 (23%)	86 (11%)	2.37 (1.79–3.14)	927 (43%)	323 (24%)	2.42 (2.10–2.79)	2744 (64%)	1136 (41%)	2.58 (2.35–2.83)	0.3
Mini-GRACE risk score‡	139 (121–158)	139 (120–158)		141 (122–160)	142 (124–160)		137 (119–158)	143 (125–161)		
Transfer										
In	27 (2%)	10 (1%)	1.76 (0.77–3.99)	91 (4%)	12 (1%)	4.64 (2.71–7.95)	353 (9%)	66 (4%)	2.74 (2.20-3.41)	0.7
Out	74 (5%)	70 (9%)	0.58 (0.40-0.85)	111 (5%)	164 (11%)	0.39 (0.31–0.51)	232 (4%)	520 (16%)	0.21 (0.17-0.25)	<0.001

CABG indicates coronary artery bypass grafting; CI, confidence interval; eGFR, estimated glomerular filtration rate; GRACE, Global Registry of Acute Coronary Events; OR, odds ratio; and PCI, percutaneous coronary intervention. *Category variables displayed as number (weighed percentage). +With patients in rural hospital as the reference group. ‡Median (interquartile range). §Excluding patients who were transferred in. ¶Among patients with the measurement.

	2001			2006				P for		
	Urban*	Rural*	OR (95% CI)†	Urban*	Rural*	OR (95% CI)†	Urban*	Rural*	OR (95% CI)†	Interaction
Reperfusion therapies										
Eligible for reperfusion	46%	46%	1.03 (0.86–1.23)	44%	50%	0.87 (0.76–0.99)	45%	54%	0.81 (0.73–0.89)	
No reperfusion‡	41%	53%	0.60 (0.45–0.81)	42%	50%	0.72 (0.59–0.88)	46%	43%	1.11 (0.97–1.28)	< 0.001
Primary PCI‡	17%	0%		25%	6%	4.89 (3.51–6.82)	37%	15%	3.21 (2.69–3.83)	< 0.001
Fibrinolytic therapy‡	42%	47%	0.83 (0.62–1.12)	33%	43%	0.63 (0.52–0.77)	18%	42%	0.30 (0.26–0.35)	< 0.001
Admission-to-needle time, min§	40 (5–130)	50 (0–200)		45 (10–95)	40 (4–105)		45 (17–90)	40 (10-88)		
Acute medications										
Aspirin ≤24 h‡	82%	77%	1.37 (1.07–1.75)	90%	82%	2.08 (1.71–2.53)	92%	89%	1.53 (1.29–1.82)	0.7
Clopidogrel ≤24 h‡	3%	0%		63%	23%	5.66 (4.86-6.60)	91%	67%	4.86 (4.25–5.55)	0.5
β -Blockers ≤24 h‡	60%	39%	2.32 (1.71–3.16)	67%	59%	1.37 (1.11–1.68)	56%	60%	0.82 (0.71–0.95)	< 0.001
Statins‡	41%	13%	4.45 (3.43–5.78)	83%	65%	2.64 (2.26-3.09)	95%	88%	2.35 (1.96–2.81)	0.4
ACE inhibitors/ARB‡	64%	58%	1.25 (1.02–1.54)	74%	66%	1.41 (1.22–1.64)	66%	68%	0.90 (0.81–1.00)	<0.001
ТСМ	44%	78%	0.23 (0.18-0.28)	50%	81%	0.23 (0.20-0.27)	61%	82%	0.34 (0.30–0.39)	< 0.001
MgSO ₄	32%	35%	0.90 (0.73–1.11)	19%	19%	0.98 (0.82–1.16)	16%	17%	0.94 (0.82–1.07)	0.9
Procedures										
Cardiac catheterization	20%	2%	15.16 (8.01–28.69)	37%	8%	6.55 (5.31–8.07)	55%	19%	5.27 (4.68-5.92)	0.001
PCI (nonprimary)	5%	1%	6.13 (2.51–14.67)	17%	4%	4.56 (3.45–6.02)	28%	6%	5.87 (4.92-7.00)	0.2
CABG	2%	0%		2%	0%		1%	0%		
Intra-aortic balloon pump	1%	0%	5.75 (0.61–53.97)	2%	0%		4%	0%	9.27 (4.81–17.84)	0.5
Testing										
Troponin	31%	9%	4.82 (3.54–6.56)	55%	34%	2.31 (2.02–2.66)	71%	65%	1.33 (1.20–1.48)	<0.001
Creatinine	74%	48%	3.07 (2.49–3.78)	90%	77%	2.71 (2.25–3.26)	96%	94%	1.49 (1.20–1.86)	< 0.001

Table 3. Changes in Treatments, Tests, and Procedure Use Among Patients With ST-Segment–Elevation Myocardial Infarction

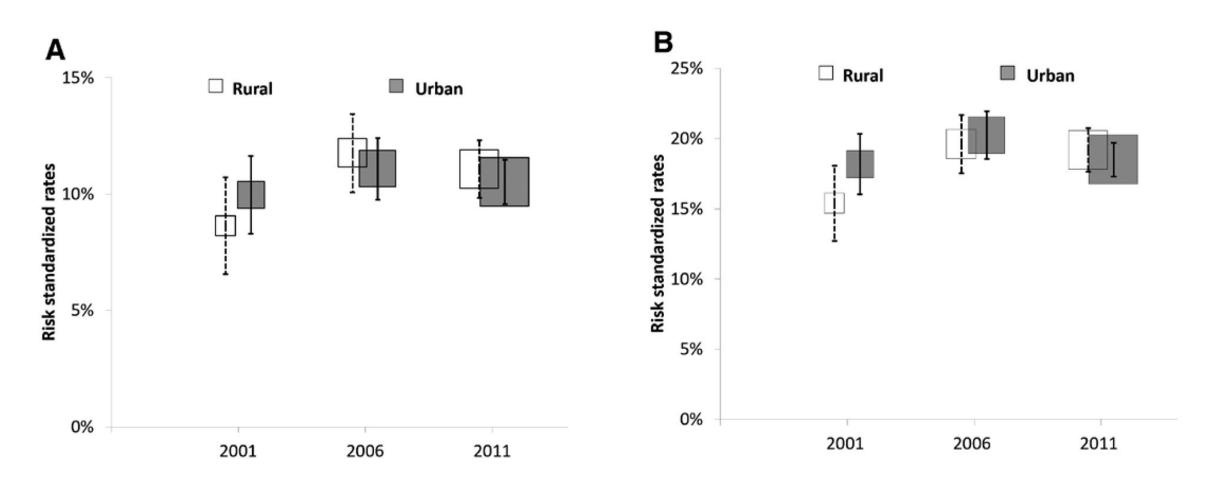


Figure 2. Differences in risk-adjusted rates of in-hospital outcomes between rural and urban hospitals over time.

A, In-hospital death or treatment withdrawal. **B**, In-hospital complications. The covariates included (1) demographic characteristics (age and sex); (2) medical history and risk factors (history of coronary heart disease, myocardial infarction, diabetes mellitus, hypertension, dyslipidemia, and stroke, as well as currently smoking); and (3) clinical features (chest discomfort for >10 min, duration from symptom onset to admission, as well as blood pressure, heart rate, acute stroke, and cardiac arrest at admission). The confidence intervals for risk-adjusted rates were calculated based on the standard error of proportion (the square root of P [1-P]/n).

Conclusion

- Our study demonstrates narrowing treatment gaps and similar patient outcomes after STEMI in urban and rural hospitals in China between 2001 and 2011.
- Although urban–rural disparities in evidence-based treatment for myocardial infarction in China have largely been eliminated, substantial gaps in quality of care persist in both settings. In addition, urban hospitals providing more resource-intensive care did not achieve better outcomes.
- This not only underscores encouraging trends for achieving more equitable care but also highlights substantial opportunities to improve the quality and value of care in both settings.
- To achieve exemplary performance and optimal outcomes, investments to improve capacity and access to care must be accompanied with the implementation of systematic quality measurements and incentive strategies.