Quality of Care Delivered by General Internists who Graduated from Foreign versus U.S. Medical Schools in U.S. Hospitals: Observational Study

(Online-Only Material)

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Supplementary Appendix 1

Licensure process for international medical graduates to practice in the U.S.

In order for the international medical graduates (IMGs) to practice medicine in the U.S., they are required to pass United States Medical Licensing Examination (USMLE) (Step 1, Step 2 Clinical Knowledge [CK], and Step 2 Clinical Skills [CS]) and complete residency training in the U.S.[1] USMLE examinations cost them more than $3,000 including international test delivery surcharges.[2] While Step 1 and Step 2 CK can be taken at examination centers outside the U.S., IMGs are usually required to travel to the U.S. to take Step 2 CS, which puts additional financial burden on IMGs. Even if IMGs have successfully passed USMLE examinations and acquired Educational Commission for Foreign Medical Graduates (ECFMG) certification, IMGs who would like to practice in the U.S. should complete a residency program accredited by Accreditation Council for Graduate Medical Education (ACGME) in the U.S. or Canada, often in addition to the residency training they have already received in their home country. In general, IMGs enter residency programs through the National Resident Matching Program.

Physician database collected by Doximity

Physician characteristics were obtained by linking the National Provider Identifier (NPI) to a database assembled by Doximity, a company that provides online professional networking services for U.S. physicians. Doximity has collected information on physicians for all U.S. physicians – including registered members of the service and non-registered physicians – from multiple sources and data partnerships, including the National Plan and Provider Enumeration System NPI Registry, the American Board of Medical Specialties, other specialty societies, state licensing boards, and collaborating hospitals and medical schools. Approximately 95% of physicians who were treating Medicare beneficiaries in our data could be found in the Doximity database. Details and validation of the Doximity database are described elsewhere.[3-5]

Assignment of patients to physicians

For each hospitalization, we assigned a physician who accounted for the largest Part B spending. We focused on Part B spending because it encompasses professional and other services at the discretion of physicians; and for hospitalized patients, Part A spending is largely invariant to physician decisions on

an individual patient's treatment because of the fixed DRG payment (only 1.0% of hospitalizations in our data received an outlier payment). It is also possible that a patient was admitted on a weekend or during the night but most of the clinical decisions about that patient's care happened in subsequent days by a different physician. In this case, the practice style of the second physician, not the admitting physician, should be responsible for the outcomes of that patient. Similar methods have been used by other studies.[5-8] As a sensitivity analysis, we used two alternative methods for assigning physicians to patients, (1) assigning physicians who accounted for the largest number of evaluation-and-management (E&M) claims and (2) assigning physicians who billed the first E&M claim, and found that they produce nearly identical results. For patients transferred to other acute care hospitals, we attributed patient outcomes to the physician of the initial hospitalization.[9 10]

Statistical analysis

We examined whether patient mortality rates differed between IMGs and U.S. medical graduates (USMGs). To create a homogeneous group of physicians who underwent similar medical school training, we restricted to graduates of allopathic medical schools. We constructed three models. First, we compared patient outcomes between IMGs and USMGs after adjusting for patient characteristics using a multivariable logistic regression model. Second, we adjusted for both patient and physician characteristics, thereby comparing adjusted outcomes of patients treated by IMGs versus USMGs across hospitals. Third, because IMGs may practice in hospitals with otherwise higher rates of mortality and readmissions (e.g., rural hospitals[11 12]), we estimated the above multivariable regression model with the additional inclusion of hospital fixed effects, effectively comparing IMGs and USMGs within the same hospital.[13-15] To account for potential correlation of outcomes among patients treated by the same physician, we clustered standard errors at the physician level.[16] We presented risk-adjusted patient mortality rates, calculated by estimating predicted probabilities of death for each hospitalization averaged over the distribution of covariates in our national sample and fixing the indicator variable for IMG at either one or zero (known as the marginal standardization form of predictive margins[17]). We used similar methods for the analyses of readmissions (using multivariable logistic regression models) and costs (using multivariable ordinary least squares regression models).

Sensitivity analyses

We conducted a series of sensitivity analyses. First, to address the possibility that IMGs may treat patients with lesser or greater unmeasured illness severity, we restricted the study population to patients treated by hospitalist physicians. Hospitalists are physicians who specialize in the care of hospitalized patients. The specialty of hospitalist in the U.S. health system, which began in mid-1990s, is fast emerging; it is estimated that approximately 21,100 to 22,900 hospitalists were practicing in the U.S. in 2010.[18] Hospitalists typically work in shifts, and therefore, within the same hospital, patients treated by hospitalists are plausibly quasi-randomized to a given physician based on that physician's work schedule.[5 19] We used a previously validated definition of hospitalist as general internists with at least 20 E&M claims in a given year (equivalent to 5 or more E&M claims in a 5% sample), who filed at least 90% of their total E&M claims in an inpatient setting as defined by Current Procedural Terminology [CPT] codes 99221-99223, 99231-99233, and 99251-99255. This approach had been validated with a high sensitivity (84.2%) specificity (96.5%), and a positive predictive value (88.9%) for identifying hospitalists in the Medicare sample.[20]

Second, to test sensitivity of our findings to how we attributed patients to physicians, we attributed patients to physicians using 2 alternative methods: (1) attributing to physicians who had largest number of evaluation and management (E&M) claims and (2) attributing to physicians who billed the first E&M claim for a given hospitalization. Similar methods have been used in previous studies.[5-8]

Third, while U.S. citizens who go abroad for medical school (U.S. citizen IMGs) constitute about one-fifth of all IMGs,[21] we could not distinguishing U.S. citizen IMGs from non-U.S. citizen IMGs in our data. Studies have suggested that U.S. citizen IMGs who attend medical schools in Central America and the Caribbean countries may not perform well.[22 23] In order to minimize the influence of these U.S. citizen IMGs, we reanalyzed the data after excluding IMGs who graduated from medical schools located in Central America and the Caribbean countries (because three quarters of U.S. citizen IMGs graduated from medical schools in these countries[23-25]).

Fourth, as differences in length of stay (LOS), utilization of care (total Part B spending per hospitalization), or in discharge location may explain the difference in patient outcomes between IMGs and USMGs, we further adjusted our regression models for these variables. LOS and utilization of care were modeled as continuous variables with quadratic and cubic terms to allow for a non-linear relationship. Discharge location was used as a categorical variable: home, skilled nursing facilities (SNFs), rehabilitation facility, hospice, and others.

Fifth, in order to address the possibility that unobserved care preferences of patients such as do-not-resuscitate (DNR) directives may confound our findings, we reanalyzed the data after excluding patients with cancer (as cancer is one of the strongest predictors of DNR directives[26]) and patients who were discharged to hospice.

Sixth, it is possible that IMGs may be more or less likely to work in ICUs as intensivists and have severely ill patients. To address this issue, we reanalyzed the data after excluding hospitals with a medical ICU.

Seventh, it is possible that residents are billing Medicare claims on behalf of their attending physicians at teaching hospitals, and differences in patient outcomes may be due to the quality of care delivered by residents. To address this, we stratified our sample by teaching status of hospitals (major teaching, minor teaching, and non-teaching hospitals), and within each group, we compared IMGs and USMGs (adjusted for patient and physician characteristics and hospital fixed effects).

Finally, we investigated whether patient outcomes varied by countries where IMGs were trained. We restricted to eight countries that had the largest number of hospitalized patients in our sample (India, Pakistan, Philippines, Syria, Nigeria, Mexico, Egypt, and China) to avoid unstable estimates.

Data preparation was conducted using SAS, version 9.4 (SAS Institute), and analyses were performed using Stata, version 14 (Stata-Corp).

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Table A. ICD-9 (*International Classification of Diseases, 9th Edition*) codes

Condition	ICD-9 codes
Sepsis	0031, 0202, 0223, 0362, 0380, 0381, 03810, 03811, 03812, 03819, 0382, 0383, 03840, 03841, 03842, 03843, 03844, 03849, 0388, 0389, 0545, 449, 77181, 7907, 99591, 99592
Pneumonia	00322, 0203, 0204, 0205, 0212, 0221, 0310, 0391, 0521, 0551, 0730, 0830, 1124, 1140, 1144, 1145, 11505, 11515, 11595, 1304, 1363, 4800, 4801, 4802, 4803, 4808, 4809, 481, 4820, 4821, 4822, 4823, 48230, 48231, 48232, 48239, 4824, 48240, 48241, 48242, 48249, 4828, 48281, 48282, 48283, 48284, 48289, 4829, 483, 4830, 4831, 4838, 4841, 4843, 4845, 4846, 4847, 4848, 485, 486, 5130, 5171
Congestive heart failure	39891, 4280, 4281, 42820, 42821, 42822, 42823, 42830, 42831, 42832, 42833, 42840, 42841, 42842, 42843, 4289
Chronic obstructive pulmonary disease	490, 4910, 4911, 4912, 49120, 49121, 49122, 4918, 4919, 4920, 4928, 494, 4940, 4941, 496
Urinary tract infection	03284, 59000, 59001, 59010, 59011, 5902, 5903, 59080, 59081, 5909, 5950, 5951, 5952, 5953, 5954, 59581, 59582, 59589, 5959, 5970, 59780, 59781, 59789, 59800, 59801, 5990
Arrhythmia	4270, 4271, 4272, 42731, 42732, 42760, 42761, 42769, 42781, 42789, 4279, 7850, 7851

Table B. Patient outcomes between USMGs and IMGs, by primary diagnosis

	No. of hospitalizations (No. of physicians)	Adjusted patient outcomes (95%CI)		Adjusted OR/difference (95%CI) IMG vs USMG	p-value
		IMGs	USMGs		
30-day mortality rate					
Sepsis	107,778 (26,273)	**24.8%** (24.4% to 25.2%)	**25.0%** (24.6% to 25.4%)	**0.99** (0.95 to 1.03)	0.52
Pneumonia	85,959 (24,877)	**11.1%** (10.8% to 11.4%)	**11.8%** (11.5% to 12.2%)	**0.92** (0.87 to 0.97)	0.004
CHF	81,497 (24,226)	**12.2%** (11.9% to 12.5%)	**12.8%** (12.4% to 13.1%)	**0.94** (0.89 to 0.99)	0.03
COPD	50,856 (17,152)	**6.6%** (6.3% to 6.9%)	**7.0%** (6.6% to 7.3%)	**0.94** (0.86 to 1.03)	0.19
UTI	51,125 (18,047)	**7.5%** (7.1% to 7.8%)	**7.3%** (6.9% to 7.6%)	**1.03** (0.94 to 1.12)	0.57
Arrhythmia	26,618 (12,621)	**8.0%** (7.6% to 8.5%)	**8.5%** (8.0% to 9.0%)	**0.93** (0.83 to 1.05)	0.26
30-day readmission rate					
Sepsis	93,080 (24,548)	**16.6%** (16.2% to 16.9%)	**16.3%** (15.9% to 16.7%)	**1.02** (0.97 to 1.06)	0.42
Pneumonia	85,328 (25,161)	**15.1%** (14.8% to 15.5%)	**15.6%** (15.2% to 15.9%)	**0.96** (0.92 to 1.01)	0.13
CHF	81,331 (24,531)	**21.4%** (21.0% to 21.8%)	**21.0%** (20.5% to 21.4%)	**1.03** (0.99 to 1.07)	0.18
COPD	62,590 (20,969)	**19.5%** (19.0% to 19.9%)	**19.8%** (19.3% to 20.3%)	**0.98** (0.93 to 1.03)	0.39
UTI	59,332 (20,876)	**15.6%** (15.2% to 16.0%)	**15.6%** (15.1% to 16.1%)	**1.00** (0.95 to 1.06)	0.93
Arrhythmia	34,402 (16,036)	**16.1%** (15.5% to 16.6%)	**16.3%** (15.7% to 17.0%)	**0.98** (0.91 to 1.05)	0.56
Costs of care					
Sepsis	115,325 (27,308)	**$1634** ($1617 to $1650)	**$1552** ($1534 to $1571)	**+$82** (+$54 to +$109)	<0.001
Pneumonia	94,851 (26,812)	**$1077** ($1065 to $1088)	**$1024** ($1012 to $1036)	**+$52** (+$34 to +$71)	<0.001
CHF	89,363 (26,044)	**$1188** ($1177 to $1199)	**$1138** ($1126 to $1151)	**+$49** (+$31 to +$67)	<0.001
COPD	67,934 (22,519)	**$899** ($889 to $908)	**$866** ($856 to $876)	**+$33** (+$17 to +$48)	<0.001
UTI	65,000 (22,802)	**$791** ($783 to $798)	**$754** ($746 to $763)	**+$36** (+$24 to +$49)	<0.001
Arrhythmia	40,808 (18,862)	**$1000** ($988 to $1011)	**$946** ($933 to $958)	**+$54** (+$35 to +$73)	<0.001

Risk-adjusted mortality with additional adjustment for physician characteristic and with hospital fixed effects (Model 3). Costs of care are defined as an average total Part B spending per hospitalization. Abbreviations: IMG, international medical graduate; USMG, U.S. medical graduate; OR, odds ratio; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.

Table C. Characteristics of patients treated by hospitalist physicians, international versus U.S. medical graduates. Values are numbers (percentages) unless stated otherwise.

		International Medical Graduates (n=8,975)	U.S. Medical Graduates (n=8,786)
Number of patients, n		383,137	307,681
Patient's age, y, mean (SD)		80.4 (8.5)	80.7 (8.5)
Female		232,370 (60.7%)	186,162 (60.5%)
Race	White	315,242 (82.3%)	254,904 (82.9%)
	Black	38,761 (10.1%)	30,041 (9.8%)
	Hispanic	19,029 (5.0%)	12,394 (4.0%)
	Other races	10,105 (2.6%)	10,342 (3.4%)
Household income, $, mean (SD)		56,561 (22,155)	57,955 (23,196)
Medicaid status		92,246 (24.1%)	69,269 (22.5%)
Coexisting condition	CHF	76,305 (19.9%)	60,643 (19.7%)
	COPD	97,307 (25.4%)	76,279 (24.8%)
	Diabetes	123,314 (32.2%)	95,599 (31.1%)
	Renal failure	85,582 (22.3%)	68,555 (22.3%)
	Neurological disorders	59,397 (15.5%)	48,073 (15.6%)
	Cancer	26,415 (6.9%)	22,361 (7.3%)
	Mental illness	57,734 (15.1%)	47,042 (15.3%)
Discharge location	Home	225,047 (58.7%)	180,297 (58.6%)
	Skilled nursing facility	100,843 (26.3%)	79,830 (26.0%)
	Rehabilitation facility	9,756 (2.6%)	6,912 (2.3%)
	Hospice	17,273 (4.5%)	15,276 (5.0%)
	Others	30,218 (7.9%)	25,366 (8.2%)

Abbreviations: CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease

Table D. Patient outcomes between USMGs and IMGs, among hospitalists

		No. of hospitalizations (No. of physicians)	Adjusted patient outcomes (95%CI)		Adjusted OR/difference (95%CI) IMG vs USMG	p-value
			IMGs	USMGs		
30-day mortality rate	Model 1: Risk-adjusted 30-day mortality*	690,818 (17,761)	**10.9%** (10.8% to 11.0%)	**11.3%** (11.2% to 11.4%)	**0.95** (0.93 to 0.97)	<0.001
	Model 2: Model 1 + physician characteristics	670,969 (17,216)	**11.0%** (10.8% to 11.1%)	**11.2%** (11.0% to 11.3%)	**0.97** (0.95 to 0.99)	0.02
	Model 3: Model 2 + hospital fixed effects	669,564 (17,188)	**10.8%** (10.7% to 10.9%)	**11.4%** (11.2% to 11.5%)	**0.94** (0.91 to 0.96)	<0.001
30-day readmission rate	Model 1: Risk-adjusted 30-day readmissions*	678,155 (17,766)	**15.3%** (15.1% to 15.4%)	**14.6%** (14.4% to 14.7%)	**1.06** (1.04 to 1.07)	<0.001
	Model 2: Model 1 + physician characteristics	658,762 (17,221)	**15.2%** (15.0% to 15.3%)	**14.7%** (14.5% to 14.8%)	**1.04** (1.02 to 1.06)	<0.001
	Model 3: Model 2 + hospital fixed effects	658,019 (17,187)	**14.9%** (14.8% to 15.0%)	**15.1%** (14.9% to 15.2%)	**0.99** (0.97 to 1.01)	0.18
Total Part B costs per hospitalization	Model 1: Risk-adjusted spending*	730,421 (17,834)	**$1079** ($1069 to $1089)	**$960** ($952 to $968)	**+$119** (+$106 to +$132)	<0.001
	Model 2: Model 1 + physician characteristics	709,363 (17,233)	**$1076** ($1067 to $1086)	**$964** ($955 to $973)	**+$113** (+$100 to +$126)	<0.001
	Model 3: Model 2 + hospital fixed effects	709,359 (17,233)	**$1044** ($1039 to $1049)	**$1005** ($999 to $1010)	**+$39** (+$31 to +$47)	<0.001

Abbreviations: IMG, international medical graduate; USMG, U.S. medical graduate; OR, odds ratio.

*Risk-adjustment using patients' age, sex, race, primary diagnosis, coexisting conditions (Elixhauser comorbidity index), median household income, Medicaid status, year indicators, and day of the week.

Table E. Patient mortality rates between USMGs and IMGs, additional analyses

	No. of hospitalizations (No. of physicians)	Adjusted 30-day mortality rate (95%CI)		Adjusted odds ratio (95%CI) IMG vs USMG	p-value
		IMGs	USMGs		
Attributing patients to physicians with largest number of E&M claims	1,113,010 (100,902)	**10.9%** (10.8% to 11.0%)	**11.4%** (11.4% to 11.5%)	**0.93** (0.92 to 0.95)	<0.001
Attributing patients to physicians who billed the first E&M claims	1,059,134 (116,742)	**10.9%** (10.8% to 11.0%)	**11.4%** (11.3% to 11.5%)	**0.94** (0.93 to 0.96)	<0.001
Excluding IMGs of Central America and the Caribbean medical schools	1,109,588 (40,333)	**11.2%** (11.1% to 11.3%)	**11.6%** (11.5% to 11.7%)	**0.94** (0.93 to 0.96)	<0.001
Additional adjustment for LOS	1,180,538 (42,708)	**11.2%** (11.1% to 11.3%)	**11.6%** (11.5% to 11.7%)	**0.95** (0.93 to 0.97)	<0.001
Additional adjustment for Part B spending	1,180,879 (42,710)	**11.2%** (11.1% to 11.3%)	**11.6%** (11.5% to 11.7%)	**0.94** (0.93 to 0.96)	<0.001
Additional adjustment for discharge location	1,180,879 (42,710)	**11.2%** (11.2% to 11.3%)	**11.6%** (11.5% to 11.6%)	**0.95** (0.93 to 0.97)	<0.001
Excluding patients with cancer and patients discharged to hospice	1,051,858 (42,107)	**7.8%** (7.7% to 7.9%)	**8.2%** (8.2% to 8.3%)	**0.94** (0.92 to 0.96)	<0.001
Excluding hospitals with ICU	151,784 (8,628)	**11.5%** (11.2% to 11.7%)	**11.9%** (11.7% to 12.2%)	**0.94** (0.90 to 0.99)	0.02

Risk-adjusted mortality with additional adjustment for physician characteristic and with hospital fixed effects (Model 3). LOS and Part B spending were used as continuous variables with quadratic and cubic terms to allow for non-linear relationship.

Abbreviations: IMG, international medical graduate; USMG, U.S. medical graduate; OR, odds ratio; LOS, length of stay.

*Patient outcomes were attributed to physicians who accounted for largest number of evaluation-and-management claims.

Table F. Patient readmission rates between USMGs and IMGs, additional analyses

	No. of hospitalizations (No. of physicians)	Adjusted 30-day readmission rate (95%CI)		Adjusted odds ratio (95%CI) IMG vs USMG	p-value
		IMGs	USMGs		
Attributing patients to physicians with largest number of E&M claims	1,084,888 (99,271)	**15.4%** (15.3% to 15.5%)	**15.5%** (15.4% to 15.6%)	**1.00** (0.98 to 1.01)	0.58
Attributing patients to physicians who billed the first E&M claims	1,031,604 (116,093)	**15.3%** (15.1% to 15.4%)	**15.5%** (15.4% to 15.6%)	**0.98** (0.97 to 0.99)	0.002
Excluding IMGs of Central America and the Caribbean medical schools	1,080,263 (40,295)	**15.4%** (15.3% to 15.5%)	**15.4%** (15.3% to 15.6%)	**1.00** (0.98 to 1.01)	0.49
Additional adjustment for LOS	1,148,653 (42,665)	**15.4%** (15.3% to 15.5%)	**15.5%** (15.4% to 15.6%)	**0.99** (0.98 to 1.01)	0.43
Additional adjustment for Part B spending	1,149,023 (42,667)	**15.3%** (15.2% to 15.4%)	**15.6%** (15.5% to 15.7%)	**0.98** (0.97 to 0.99)	0.003
Additional adjustment for discharge location	1,149,024 (42,667)	**15.4%** (15.3% to 15.5%)	**15.5%** (15.4% to 15.6%)	**0.99** (0.98 to 1.01)	0.39
Excluding patients with cancer and patients discharged to hospice	1,026,949 (42,065)	**15.7%** (15.6% to 15.8%)	**15.7%** (15.6% to 15.8%)	**1.00** (0.98 to 1.01)	0.58
Excluding hospitals with ICU	145,814 (8,074)	**15.8%** (15.5% to 16.0%)	**16.0%** (15.7% to 16.3%)	**0.98** (0.95 to 1.02)	0.31

Risk-adjusted readmission rates with additional adjustment for physician characteristic and with hospital fixed effects (Model 3). LOS and Part B spending were used as continuous variables with quadratic and cubic terms to allow for non-linear relationship.

Abbreviations: IMG, international medical graduate; USMG, U.S. medical graduate; OR, odds ratio; LOS, length of stay.

*Patient outcomes were attributed to physicians who accounted for largest number of evaluation-and-management claims.

Table G. Patient costs of care between USMGs and IMGs, additional analyses

	No. of hospitalizations (No. of physicians)	Adjusted total Part B spending (95%CI)		Adjusted difference (95%CI) IMG – USMG	p-value
		IMGs	USMGs		
Attributing patients to physicians with largest number of E&M claims	1,168,915 (103,634)	**$1138** ($1134 to $1143)	**$1104** ($1100 to $1109)	**+$34** (+$27 to +$40)	<0.001
Attributing patients to physicians who billed the first E&M claims	1,111,028 (120,779)	**$1099** ($1095 to $1103)	**$1117** ($1113 to $1121)	**-$18** (-$24 to -$12)	<0.001
Excluding IMGs of Central America and the Caribbean medical schools	1,185,852 (41,184)	**$1143** ($1138 to $1148)	**$1096** ($1091 to $1101)	**+$47** (+$39 to +$55)	<0.001
Additional adjustment for LOS	1,240,491 (42,943)	**$1143** ($1140 to $1147)	**$1099** ($1094 to $1103)	**+$44** (+$39 to +$50)	<0.001
Additional adjustment for discharge location	1,240,867 (42,944)	**$1145** ($1140 to $1149)	**$1098** ($1093 to $1104)	**+$46** (+$39 to +$54)	<0.001
Excluding patients with cancer and patients discharged to hospice	1,105,865 (42,434)	**$1114** ($1110 to $1119)	**$1069** ($1063 to $1074)	**+$46** (+$38 to +$53)	<0.001
Excluding hospitals with ICU	158,580 (9,039)	**$1147** ($1135 to $1159)	**$1111** ($1096 to $1125)	**+$36** (+$16 to +$57)	<0.001

Risk-adjusted spending with additional adjustment for physician characteristic and with hospital fixed effects (Model 3). LOS was used as a continuous variable with quadratic and cubic terms to allow for non-linear relationship.

Abbreviations: IMG, international medical graduate; USMG, U.S. medical graduate; LOS, length of stay.

*Patient outcomes were attributed to physicians who accounted for largest number of evaluation-and-management claims.

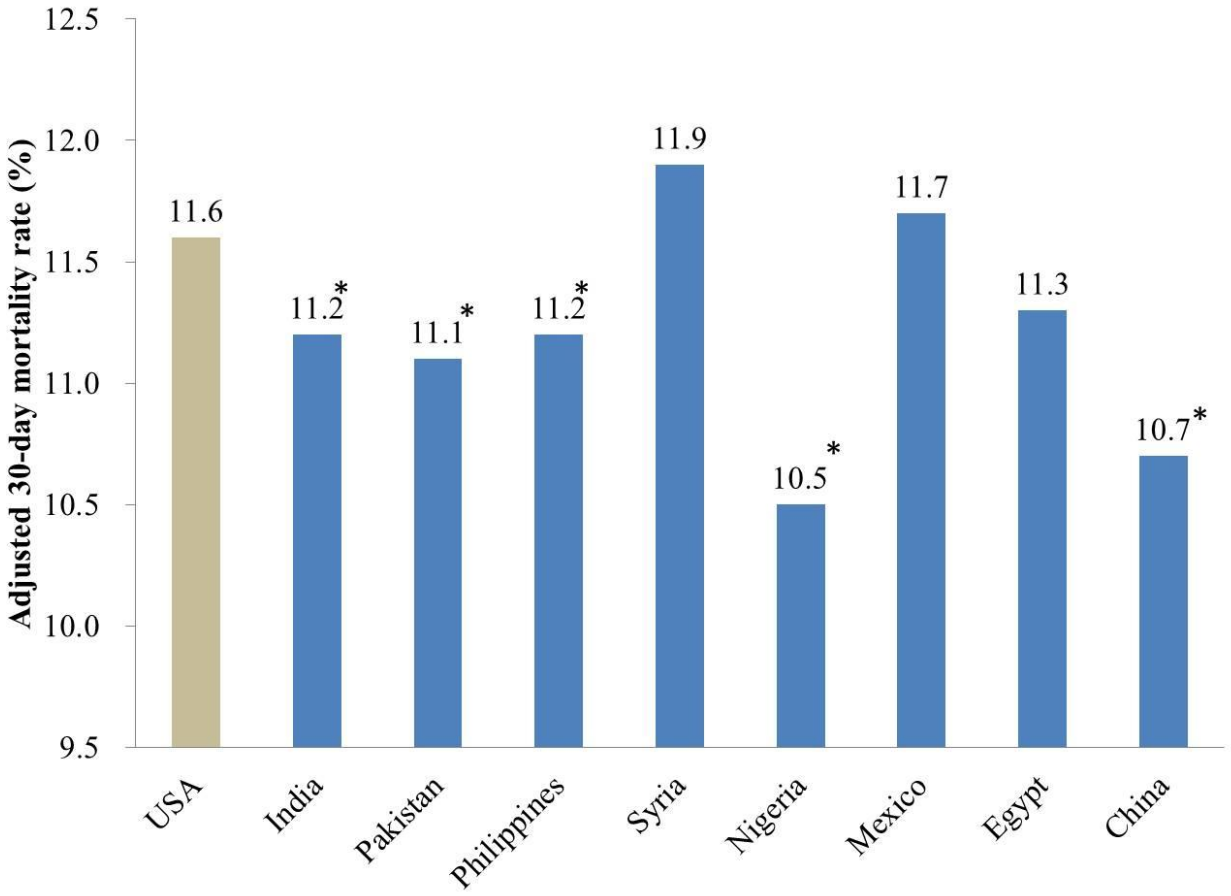
Table H. Stratified analysis by teaching status of hospitals

		No. of hospitalizations (No. of physicians)	Adjusted patient outcomes (95%CI)		Adjusted OR/difference (95%CI) IMG vs USMG	p-value
			IMGs	USMGs		
30-day mortality rate	Major teaching hospitals	183,383 (13,242)	**10.2%** (9.9% to 10.4%)	**10.8%** (10.5% to 11.0%)	**0.93** (0.88 to 0.97)	0.001
	Minor teaching hospitals	408,108 (18,734)	**11.3%** (11.1% to 11.4%)	**11.7%** (11.5% to 11.8%)	**0.95** (0.93 to 0.98)	0.002
	Non-teaching hospitals	580,542 (21,911)	**11.5%** (11.3% to 11.6%)	**11.9%** (11.3% to 11.6%)	**0.95** (0.93 to 0.97)	<0.001
30-day readmission rate	Major teaching hospitals	184,352 (13,418)	**16.7%** (16.5% to 17.0%)	**16.7%** (16.4% to 16.9%)	**1.01** (0.98 to 1.04)	0.71
	Minor teaching hospitals	400,402 (18,390)	**15.1%** (15.0% to 15.3%)	**15.2%** (15.1% to 15.4%)	**0.99** (0.97 to 1.01)	0.51
	Non-teaching hospitals	556,810 (20,760)	**15.2%** (15.0% to 15.3%)	**15.2%** (15.1% to 15.4%)	**0.99** (0.97 to 1.01)	0.54
Total Part B costs per hospitalization	Major teaching hospitals	199,626 (14,313)	**$1224** ($1212 to $1237)	**$1172** ($1159 to $1185)	**+$52** (+$33 to +$72)	<0.001
	Minor teaching hospitals	431,304 (19,191)	**$1167** ($1159 to $1175)	**$1118** ($1110 to $1126)	**+$49** (+$37 to +$61)	<0.001
	Non-teaching hospitals	601,845 (22,188)	**$1103** ($1096 to $1109)	**$1061** ($1054 to $1069)	**+$41** (+$30 to +$52)	<0.001

Abbreviations: IMG, international medical graduate; USMG, U.S. medical graduate; OR, odds ratio.

*Risk-adjustment using patients' age, sex, race, primary diagnosis, coexisting conditions (Elixhauser comorbidity index), median household income, Medicaid status, year indicators, and day of the week.

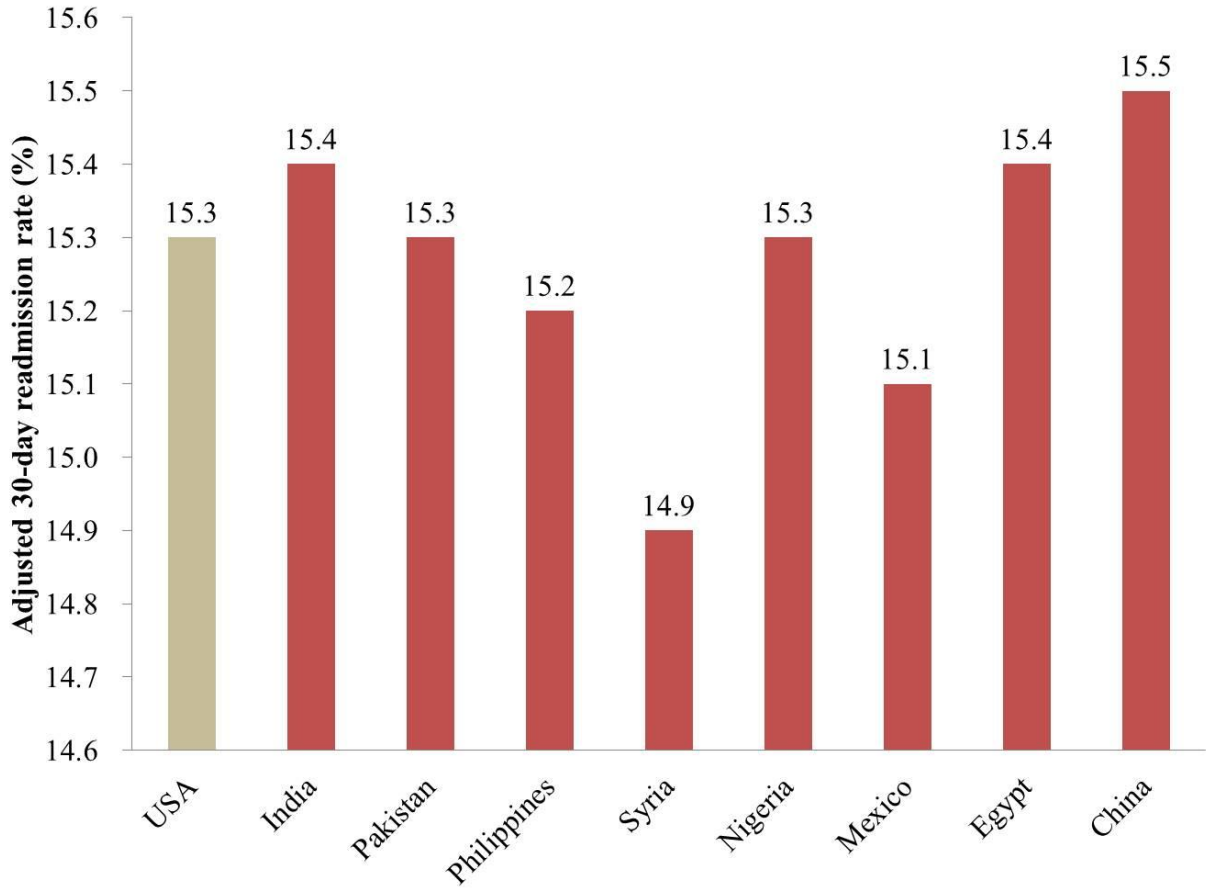
Fig A. Adjusted patient mortality rates by country



Risk-adjusted mortality rates with additional adjustment for physician characteristic and with hospital fixed effects (Model 3).

*Statistically significantly different from the outcomes of patients treated by U.S. medical graduates with $p<0.05$.

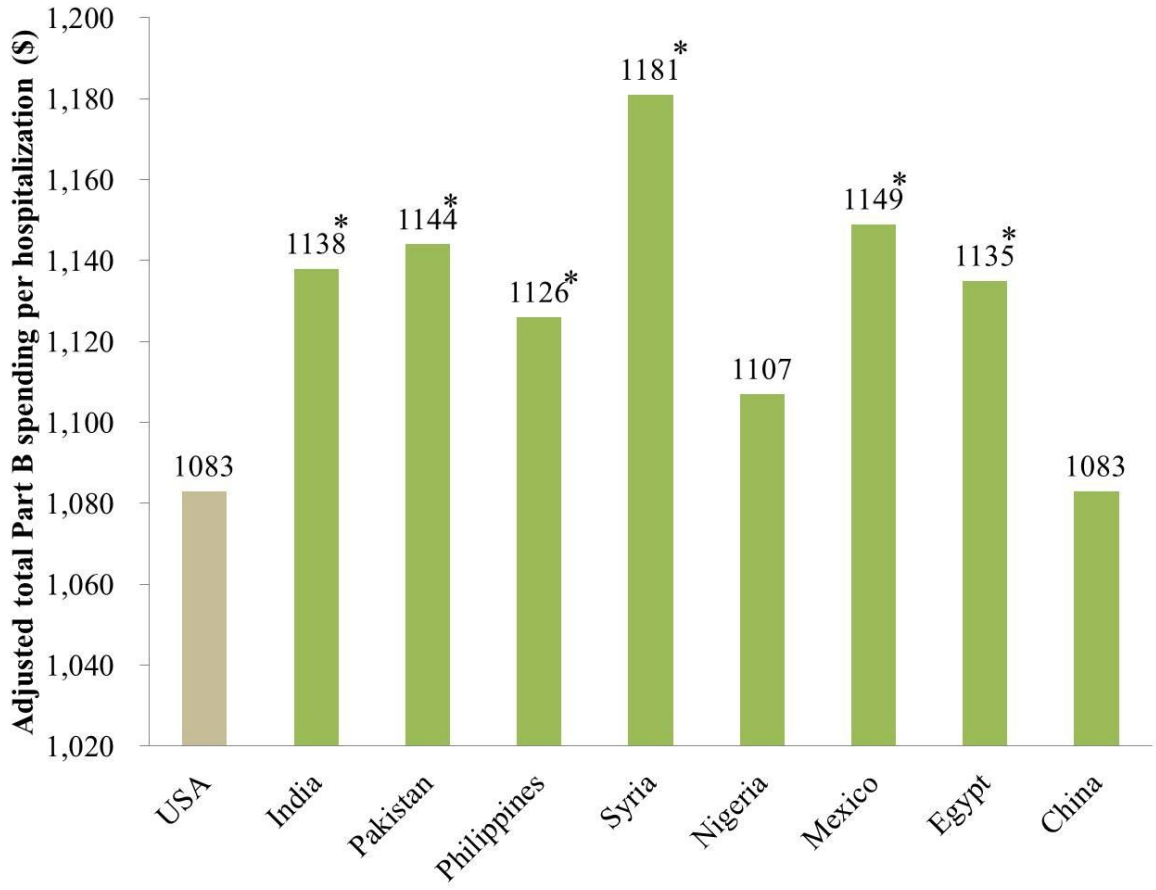
Fig B. Adjusted patient readmission rates by country



Risk-adjusted readmission rates with additional adjustment for physician characteristic and with hospital fixed effects (Model 3).

The readmission rates for all countries studied were not statistically significantly different ($p>0.05$) from patients treated by U.S. medical graduates.

Fig C. Adjusted patient costs of care by country



Risk-adjusted costs of care with additional adjustment for physician characteristic and with hospital fixed effects (Model 3).

*Statistically significantly different from the outcomes of patients treated by U.S. medical graduates with $p<0.05$.