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Evaluating The Quality Of Care Provided By Graduates Of International Medical Schools

ABSTRACT One-quarter of practicing physicians in the United States are graduates of international medical schools. The quality of care provided by doctors educated abroad has been the subject of ongoing concern. Our analysis of 244,153 hospitalizations in Pennsylvania found that patients of doctors who graduated from international medical schools and were not U.S. citizens at the time they entered medical school had significantly lower mortality rates than patients cared for by doctors who graduated from U.S. medical schools or who were U.S. citizens and received their degrees abroad. The patient population consisted of those with congestive heart failure or acute myocardial infarction. We found no significant mortality difference when comparing all international medical graduates with all U.S. medical school graduates.

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Graduates of international medical schools make up approximately one-quarter of U.S. practicing physicians.[1,2] Their numbers have varied over time with changes in immigration policy, health care provider needs in the United States, and a host of other factors. However, proposed responses to the existing and projected U.S. physician shortage raise important policy considerations regarding international medical graduates.[3]

Background

U.S. medical schools have reacted to the physician shortage by increasing their class sizes; new medical schools have also been created. However, the number of residency positions has not increased proportionately.[4,5] The increased class size offers U.S. citizens who might otherwise have gone abroad for medical school the opportunity to stay home and study. But a restricted number of residency positions means fewer opportunities for both U.S. and international graduates. This study provides data on the outcomes of care by both groups.

We hope that the results will serve as a springboard for changes in medical education practices and opportunities.

As a first step to entering the United States, graduates of international schools must be certified by the Educational Commission for Foreign Medical Graduates (ECFMG). This certification process includes primary-source verification of graduates' educational credentials, such as medical school diplomas and transcripts. It also includes successful performance on the first two steps of the U.S. Medical Licensing Examination (USMLE). To obtain a license, graduates of international schools must acquire accredited residency training in the United States and pass the third step of the examination. At the completion of their training, graduates can seek specialty board certification, which requires additional testing.

Despite this rigorous process, there has been ongoing concern about the competence of graduates of international schools. A 1991 summary of the literature concluded that on certain measures of quality, these graduates did not do as well as graduates of U.S. medical schools.[6] For instance, international graduates performed

worse than U.S. medical school graduates on licensing examinations. International graduates also scored lower on program directors' ratings and specialty board certification rates in internal medicine—the most popular specialty for international graduates.[7–11] However, by the mid-1990s, international medical graduates were outperforming U.S. graduates on in-training examinations in internal medicine.[12]

Of special interest are U.S. citizens who go abroad for medical school. They constitute about one-fifth of the international graduates certified by the Educational Commission for Foreign Medical Graduates, and the vast majority of them seek graduate training in the United States.[2] International graduates who are U.S. citizens, especially those who attended medical schools in the Caribbean, do not perform as well as U.S. graduates or international graduates who are not U.S. citizens on the USMLE or on specialty board exams.[8,13–15]

Much of the research on the competence of international graduates has focused largely on educational measures of quality. A more fundamental question is this: Are there differences in clinical outcomes for patients cared for by these physicians? In a 1991 review, Stephen Mick and Maureen Comfort found that the research was insufficient to answer that fundamental question. Since then, however, the ability to use information on patient outcomes to assess the effectiveness of groups of physicians has improved.[16–19]

This study examines inpatient death rates and lengths-of-stay for patients with congestive heart failure or acute myocardial infarction—or heart attack—cared for by non-U.S.-citizen international graduates, U.S.-citizen international graduates, and U.S. medical school graduates. These two patient conditions were chosen because they are common, and the preponderance of care for them is provided by internists, family physicians, and cardiologists. These specialties account for 44 percent of all international medical graduates in active practice in the United States; focusing on them allowed for the level of specialization—primary care versus cardiology—to be controlled for in the analysis.[20]

Study Data And Methods

DATA SOURCES AND PARTICIPANTS We conducted a retrospective study using inpatient records from Pennsylvania for the period from January 1, 2003, to December 31, 2006. The data were obtained from the Pennsylvania Health Care Cost Containment Council, which required all facilities in the state—except Veterans Affairs hospitals, skilled nursing facilities, and state psychiatric hospitals that perform inpatient services—to submit a record for each discharge. The facilities gave uniform billing standards data directly to the council. They were also required to report patient demographics; coexisting health conditions; and key clinical findings, such as patient history, laboratory values, vital signs, and clinical signs and symptoms, from the beginning of the inpatient stay.

These data were submitted to MediQual, an independent clinical information management business offering health care quality measurement support services, where a proprietary risk calculation model was applied to derive the Atlas Admission Severity index.[21] This index is an indication of how sick the patient was on admission; it is expressed on a scale reflecting the probability of death. The index and probability of death range from "no clinical instability" with less than a 0.1 percent probability of death to "maximal instability" with greater than a 49.9 percent probability of death. This severity index was sent to the Pennsylvania cost containment council, where it was combined with the inpatient records.

Using a common identifier, we matched the council's data with both the 2008 American Medical Association (AMA) Physician Masterfile and the Educational Commission for Foreign Medical Graduates database. The AMA Masterfile contains information on all physicians who reside in the United States and have met the credentialing requirements necessary for recognition. The ECFMG database contains information on all international graduates who have attempted to establish their readiness for residency training in the United States.

We selected hospitalizations with a principal diagnosis of congestive heart failure or acute myocardial infarction because they are common conditions and are often used as markers of quality of care.[22] Congestive heart failure hospitalizations were excluded if the patient was younger than eighteen, the discharge disposition was missing, or the patient was transferred to another short-term hospital. Acute heart attack hospitalizations were excluded if the patient was younger than eighteen, the disposition when the patient was discharged or the admission source was missing, or the patient was transferred to or from another short-term hospital.

We further limited our analyses to hospitalizations where the attending physician graduated from medical school after 1958, the year the Educational Commission for Foreign Medical Graduates was established. The attending physician pool was also restricted to those who specialized

Are there differences in clinical outcomes for patients cared for by international graduates?

in family medicine, internal medicine, or cardiology. These physicians provided the vast majority of care for the principal diagnoses, and this restriction reduced the possibility that physician specialty might confound the results. We failed to match 1,860 hospitalization records (fewer than 1 percent) with physicians in the AMA Masterfile.

DATA ELEMENTS From the Pennsylvania Health Care Cost Containment Council records, we obtained information on patients' age, sex, race, principal diagnosis, medical insurance, year of admission, and source of admission. These records also contained the Atlas Admission Severity index and the outcome measures used in the study: length-of-stay and discharge status, which indicated mortality.

The AMA Masterfile contained information on physicians' year of birth and year of graduation from medical school, self-reported specialization, and specialty board certification. The Educational Commission for Foreign Medical Graduates database provided information on whether physicians were international graduates, as well as their citizenship when they entered medical school.

With the information from these sources, we were able to calculate additional variables. As a measure of time in practice, we calculated years since graduation from medical school by subtracting the physician's graduation year from the year of the patient's admission. As an indicator of institutional experience, we tallied the number of congestive heart failure and acute myocardial infarction hospitalizations for each facility. Additionally, each facility's location—urban or rural—was determined by reference to the county list developed by the Pennsylvania Office of Rural Health.[23]

As an indicator of individual experience, the number of congestive heart failure and acute myocardial infarction hospitalizations was calculated for each physician. These variables allowed us to estimate the effect of international medical education on outcomes of care, independent of time in practice, institutional experience, and patient characteristics.

ANALYSES Descriptive statistics were calculated at the level of the hospitalization,[24] and we applied two separate multivariate models to assess the independent effects of the type of medical school graduate on patient mortality and length-of-stay. The models were adjusted for a number of factors, including principal diagnosis, severity of illness at admission, the institution's number of patients, urban or rural location, and the physician's number of patients.

The models were also adjusted for number of years since the physician graduated from medical school; whether the physician was a self-reported specialist in cardiovascular diseases; and whether the physician was board certified in family medicine, internal medicine, or cardiovascular diseases. Generalized estimating equations—using the GENMOD procedure, Statistical Analysis Software (SAS) version 9.1—were applied to account for the clustering of patients within physicians and physicians within hospitals.[25] We excluded deceased patients from the multivariate length-of-stay analysis.

In both models, we tested whether mortality or length-of-stay varied as a function of whether the physician was a U.S. medical school graduate, a non-U.S.-citizen international medical school graduate, or a U.S.-citizen international medical school graduate. For mortality, we made four comparisons: all international graduates with U.S. graduates; non-U.S.-citizen international graduates with U.S. graduates; U.S.-citizen international graduates with U.S. graduates; and non-U.S.-citizen international graduates with U.S.-citizen international graduates. These comparisons were used to calculate adjusted odds ratios.

POTENTIAL CONFOUNDING AND BIASING VARIABLES Physicians are clustered within hospitals in nonrandom ways, which raises concerns that the results might reflect differences among institutions rather than among physicians. Consequently, we conducted conditional regression analyses using the models described above, but eliminating hospital location and number of patients. The estimates were similar to those found with generalized estimating equations, so they are not reported. Other interactions between type of medical school graduate and database variables were found not to be statistically significant and thus are not reported.

LIMITATIONS Our study has a number of limitations. First, although we included data on facilities, physicians, and patients to limit potential biases, there may be confounding factors for which we have not accounted.

For example, the method of identifying a

physician as the attending physician of record may vary among hospitals, and it is possible that more than one doctor contributed to the care of some patients. Also, different hospitals may offer different incentives for reducing lengths-of-stay. Moreover, we were unable to assess differences in mortality after discharge because follow-up data were lacking. These issues would make it difficult to distinguish among groups of physicians and may have introduced systematic biases.

Second, this study looked at only two conditions and used only one clinical setting: the hospital. As noted above, these common conditions with important clinical outcomes are used extensively as markers of quality.[26] Nonetheless, patients were cared for by only a portion of the physician community, such as family doctors, internists, and cardiologists. For these physicians, a hospital setting captures only a part of their professional competence.

Likewise, the data come from only one state, which potentially limits the general applicability of the findings. However, Pennsylvania's patient population is large, and the state is among those with the greatest number and most diverse population of international medical graduates. Even so, future research needs to look more broadly at patients' conditions, medical procedures used to treat them, and the type of physicians treating them.

Third, over time and across countries, there are sizable differences in migration patterns, the quality of medical schools, and the attractiveness of practicing medicine in the United States. For U.S. citizens, there have been differences in the motivation to go abroad for medical education and in the quality of the schools attended. We addressed these issues by adjusting our results for time since graduation from medical school. Nonetheless, these are complex forces, and failure to capture them completely creates the potential for unknown biases. Future research should more directly address these issues, especially those related to medical school characteristics.

Results

CHARACTERISTICS OF PHYSICIANS, PATIENTS, AND HOSPITALS There were 6,113 physicians in the study. Of these, 4,616 were U.S. medical school graduates, and 83 percent of those were specialty certified. Another 1,497 physicians in the study were international graduates, 78 percent of whom were specialty certified. The 1,497 international graduates came from 391 medical schools in seventy-nine countries. Of the international graduates, 1,123 were not U.S. citizens when they entered medical school; 81 percent of them were specialty certified. Of the 374 U.S.-citizen students who graduated from international medical schools, 67 percent were specialty certified.

More physicians reported practicing family medicine (33 percent) or internal medicine (48 percent) than cardiology (19 percent). Of the family physicians, 87 percent were U.S. medical school graduates, compared to 68 percent of the internists and 75 percent of the cardiologists.

From 2003 to 2006, there were 244,153 hospitalizations with a principal admission diagnosis of congestive heart failure or acute myocardial infarction. Of these, 71 percent were cared for by U.S. graduates, 22 percent by non-U.S.-citizen international graduates, and 7 percent by U.S.-citizen international graduates. Exhibit 1 presents the characteristics of the patients by physician group. Although absolute differences were small, they were generally statistically significant.

The study included 184 hospitals. For congestive heart failure, the median facility treated 1,004 patients; half of the hospitals were within 1,320 patients of this median. For acute myocardial infarction, the median facility treated 264 patients; half of the hospitals were within 346 patients of this median.

Patient mortality was 5.4 percent overall, 3.3 percent for congestive heart failure, and 13.0 percent for acute myocardial infarction. Differences among the groups of physicians were statistically significant: Patients of non-U.S.-citizen international graduates had the lowest mortality levels, and patients of U.S.-citizen international graduates had the highest.

Mean length-of-stay was 5.28 days, with 5.12 days for congestive heart failure and 5.86 days for acute myocardial infarction. Differences among the groups of physicians were statistically significant: The patients of U.S. graduates had the shortest lengths-of-stay, and the patients of U.S.-citizen international graduates had the longest.

Exhibit 2 presents data concerning years since medical school and number of patients. The non-U.S-citizen international graduates were furthest in time from medical school and had the highest number of patients with the target conditions, followed in turn by the U.S.-citizen international graduates and the U.S. graduates.

MULTIVARIATE ANALYSES

▶ **MORTALITY:** Adjusting for characteristics of the patients, physicians, and facilities, the patients of non-U.S.-citizen international graduates had significantly lower mortality (Exhibit 3). Non-U.S.-citizen international graduates were associated with a 16 percent decrease

EXHIBIT 1

Patient Characteristics, By Type Of Medical Graduate

	Patients cared for by USMGs (N = 172,324)	Patients cared for by non-USIMGs (N = 54,360)	Patients cared for by USIMGs (N = 17,469)[a]	Patients cared for by all IMGs (N = 71,829)[b]
Age (years)			****	
18–49	4%	4%	4%	4%
50–64	13	13	12	13
65–74	19	19	18	18
75–84	35	35	37	36
85+	29	29	29	29
Sex[c]			****	****
Female	55%	56%	56%	56%
Race[d]			****	****
White	85%	85%	87%	86%
Black	12	11	12	11
Principal diagnosis[c]			**	**
Congestive heart failure	78%	78%	78%	78%
Admission severity[e]			****	****
Minimal	20%	21%	19%	20%
Moderate	54	54	54	54
Severe	25	24	25	24
Location of institution[c]			****	****
Urban	76%	65%	70%	66%
Number of in-hospital deaths[f]			****	***
Congestive heart failure	4,527 (3.4%)	1,285 (3%)	473 (3.5%)****	1,758 (3.1%)***
Acute myocardial infarction	4,977 (13.1%)	1,427 (12.2%)	547 (14.4%)****	1,974 (12.7%)
Total	9,504 (5.5%)	2,712 (5.0%)	1,020 (5.8%)	3,732 (5.2%)
Length-of-stay, mean days (SD)[g]			****	****
Congestive heart failure	5.09 (±4.35)	5.17 (±3.71)	5.30 (±4.03)****	5.20 (±3.79)****
Acute myocardial infarction	5.82 (±4.53)	5.87 (±4.41)	6.18 (±4.57)****	5.95 (±4.45)****
Total	5.25 (±4.40)	5.32 (±3.88)	5.48 (±4.17)	5.36 (±3.96)

SOURCES Pennsylvania Health Care Cost Containment Council inpatient discharge data, 2003–2006; American Medical Association Physician Masterfile, 2008; and Educational Commission for Foreign Medical Graduates applicant database. **NOTES** USMG is U.S. medical school graduate. Non-USIMG is non-U.S.-citizen international medical school graduate. USIMG is U.S.-citizen international medical school graduate. IMG is international medical school graduate. [a]Significance indicators in this column for all categories except length-of-stay are from chi-square test for three-way comparison of USMGs, non-USIMGs, and USIMGs. [b]Significance indicators in this column for all categories except length-of-stay are from chi-square test for two-way comparison of USMGs and all IMGs [c]For binary categories, only one variable is shown; the omitted categories are male (sex), acute myocardial infarction (principal diagnosis), rural (location). [d]Data are also available for Asian or Pacific Islander, Native American or Eskimo, other, and unknown. With two exceptions (other for both patients cared for by non-USIMGs and patients cared for by all IMGs), these categories were all less than or equal to 1 percent across all medical graduate types. [e]For admission severity, "none" and "maximal" are not shown; they were 1 percent or less for all medical graduate categories. [f]Percentages are number of patients admitted with each of those principal diagnoses who died. [g]p values for lengths-of-stay are from Kruskal-Wallace test of analysis of variance. **$p < 0.05$ ***$p < 0.01$ ****$p < 0.001$

in mortality relative to U.S.-citizen international graduates and a 9 percent decrease relative to U.S. graduates.

The differences in mortality of patients cared for by all international graduates and U.S. graduates (adjusted odds ratio: 0.99; 95 percent confidence interval: 0.94 to 1.04) were not statistically significant, nor were the differences

EXHIBIT 2

Mean Years Since Graduation From Medical School And Mean Number Of Hospitalizations, By Physician Group

	USMGs[a]	USIMGs[a]	Non-USIMGs	
Mean years since graduation from medical school	18.2 (±9.6)	19.2 (±7.9)	21.3 (±10.3)	Chi-square: 76.12, $p < 0.001$
Mean number of hospitalizations[b]	8.8 (±10.4)	10.5 (±12.2)	10.9 (±13.0)	Chi-square: 20.25, $p < 0.001$

SOURCES Pennsylvania Health Care Cost Containment Council inpatient discharge data, 2003–2006; American Medical Association Physician Masterfile, 2008; and Educational Commission for Foreign Medical Graduates applicant database. [a]See Exhibit 1. [b]Volume reflects number of acute myocardial infarction and congestive heart failure admissions in Pennsylvania per physician, 2003–2006.

EXHIBIT 3

Comparison Of International Medical Graduates (IMGs) With U.S. Medical Graduates (USMGs) On In-Hospital Mortality, By Various Significant Characteristics

Parameter	Adjusted odds ratio[a]	95 percent confidence interval
All IMGs versus USMGs		
Condition	1.7843	1.6815–1.8933
Admission severity		
Minimal	0.9001	0.2254–3.5945
Moderate	4.0040	1.0078–15.9092
Severe	20.4278	5.1480–81.0608
Maximal	158.9675	40.0048–631.6276
Facility volume	0.9999	0.9999–0.9999
Physician volume	0.9990	0.9985–0.9995
Years since graduation	1.0058	1.0034–1.0081
Cardiologist	1.0610	1.0046–1.1204
Board certified	0.9438	0.8933–0.9972
Urban/rural location	1.1149	1.0609–1.1719
IMG subgroups versus USMGs		
Non-USIMG versus USMG	0.9097	0.8617–0.9606
USIMG versus USMG	1.0690	0.9891–1.1535

SOURCES Pennsylvania Health Care Cost Containment Council inpatient discharge data, 2003–2006; American Medical Association Physician Masterfile, 2008; and Educational Commission for Foreign Medical Graduates applicant database. **NOTES** Statistical significance denotes that adjusted odds ratio is different from 1. USIMG is U.S.-citizen international medical school graduate. Unadjusted results are available in the online Technical Appendix, which is available by clicking on the Technical Appendix link in the box to the right of the article online. [a]Based on log-link generalized estimating equations.

between U.S.-citizen international graduates and U.S. graduates (adjusted odds ratio: 1.07; 95 percent CI: 0.99 to 1.16). However, the patients of non-U.S.-citizen international graduates had significantly lower mortality than U.S. graduates (adjusted odds ratio: 0.91; 95 percent CI: 0.86 to 0.97). Likewise, their patients had significantly lower mortality than the patients of U.S.-citizen international graduates (adjusted odds ratio: 0.85; 95 percent CI: 0.78 to 0.93).

Among the physician characteristics included in the analysis, the number of years since graduation was positively related to mortality, and the magnitude of the effect was substantial. Each additional year since graduation was associated with a 0.58 percent (95 percent CI: 0.34 percent to 0.81 percent) increase in the mortality of a physician's patients. Specialty board certification was associated with a 5.62 percent (95 percent CI: −0.003 percent to −10.67 percent) decrease in mortality, and treatment by a self-reported cardiologist was associated with a 6.1 percent (95 percent CI: 0.005 percent to 12.04 percent) increase in mortality.

▶ LENGTH-OF-STAY: Adjusting for all other variables, the patients cared for by U.S.-citizen international graduates and non-U.S.-citizen international graduates had significantly longer stays than patients of U.S. graduates.[27] For the average stay of 5.28 days, this would represent an increase of 0.21 days (95 percent CI: 0.11 to 0.37

days) for patients of U.S.-citizen international graduates and 0.16 days (95 percent CI: 0.11 to 0.26 days) for patients of non-U.S.-citizen international graduates.

Holding all other variables constant, increasing years since medical school graduation was significantly associated with longer stays, while treatment by a cardiologist or physician holding a specialty board certificate was significantly associated with shorter stays. An urban location was also significantly associated with shorter hospital stays, while hospital and physician numbers of patients did not reach levels of statistical significance.

Discussion

In this observational study, we examined whether there were differences in outcomes for patients of international medical school graduates—both non–U.S. citizens and U.S. citizens—versus outcomes for patients of U.S. medical school graduates. We found no difference in mortality when comparing all international medical graduates with U.S. graduates. This is consistent with work done in Canada comparing international graduates and Canadian graduates.[16] Moreover, it speaks to the reliability of the U.S. certification process for international medical graduates.

We also found that there were fewer in-hospital

It is reassuring that international graduates are comparable to U.S. graduates in patient mortality.

deaths among the patients of non-U.S.-citizen international graduates than was the case for patients of either U.S.-citizen international graduates or U.S. graduates. The difference between non-U.S.-citizen and U.S.-citizen international graduates was striking. Although this finding may be unique, it is not surprising, given previous research. U.S.-citizen international graduates have lower scores on the cognitive portions of the licensing examination sequence, lower ratings from training program directors, and lower rates of specialty board certification.[7,9–12]

Part of this performance difference may be due to variability in the quality of the medical schools that U.S.-citizen international graduates attend, but to some degree, it may also reflect their ability.[8,26] It will be important to monitor this possibility, since the pool of U.S. applicants to international schools is a potential source of students for U.S. medical schools as they expand.[5]

We also compared lengths-of-stay among the groups in this study. We found that the patients of international graduates had longer hospitalizations than those of U.S. graduates, although the practical significance of the difference is relatively small. Consistent with previous work, we found that lengths-of-stay were longer for patients of physicians who were further from graduation and shorter for patients of cardiologists and physicians with specialty board certification.[18,19]

It is reassuring that international graduates are comparable to U.S. graduates in terms of patient mortality, because they constitute nearly a quarter of the physicians in the United States. These findings are particularly important at a time when there is an impending shortage of physicians in the United States, and international graduates are one way of addressing the shortfall.[4,5]

Among international graduates, the apparent superior performance of non–U.S. citizens suggests that policies that affect the size of this group might have implications for quality. Our data also address some of the negative perceptions about the care provided by these physicians.[6,16]

In contrast, the apparent performance of U.S. citizens who graduate from international medical schools suggests the importance of further research to clarify whether their performance is a result of their medical education experiences or their ability. To the degree that it is the former, U.S. citizens will need information about international medical schools on which to base their application decisions. To the degree that it is the latter, and as additional training opportunities become available for U.S. citizens, medical schools and residency programs will need to be more vigilant in their selection procedures and not accept students who lack the ability to perform as physicians. ∎

NOTES

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