

Participation in U.S. Graduate Medical Education by Graduates of International Medical Schools

Paul Jolly, PhD, John Boulet, PhD, Gwen Garrison, PhD, and Mona M. Signer, MPH

Abstract

Purpose

International medical graduates (IMGs) are an important part of U.S. graduate medical education (GME) and medical practice. They make up a significant number of the participants in both the Electronic Residency Application Service (ERAS) and the National Resident Matching Program (NRMP). The authors analyze and report statistics describing the multiple pathways used by IMGs in pursuit of a U.S. residency position.

Method

This is a descriptive study of 10,328 IMGs certified by the Educational Commission for Foreign Medical Graduates (ECFMG)

between July 1, 2005 and June 30, 2006. Linked data on this cohort were obtained from the ECFMG, ERAS, and the NRMP, combined with residency data from the National GME Census. The study determined the numbers of members of the study cohort who participated in ERAS and/or the NRMP in 2003 through 2009, and who found a residency appointment in the United States between 2003 and the first half of 2010.

Results

The IMGs in the study cohort began applying for residencies in significant numbers in the year immediately

following ECFMG certification, but almost half were unsuccessful in their first attempts. Three-quarters of the members of the cohort had begun a residency by 2010.

Conclusions

IMGs make up a very substantial fraction of ERAS and NRMP participants. Although they face significant hurdles in achieving their goal, the majority of those who persist are ultimately successful. If enrollments and graduations of U.S. MD- and DO-granting medical schools continue to rise, IMGs' difficulty in finding residencies is sure to increase.

The search for a desirable residency position is an important and stressful process for medical students and medical graduates. After selecting a specialty and identifying preferred programs, the student or graduate must complete application materials, including a transcript, personal statement, and letters of recommendation, and submit those materials to the desired programs. The application process is greatly facilitated by the Electronic Residency Application Service (ERAS) of the Association of

American Medical Colleges (AAMC), which allows the candidate to complete the application online and submit documents electronically.¹ For those programs that show an interest, the applicant ordinarily must travel to interview at the program sites. Most candidates also participate in the National Resident Matching Program (NRMP). Candidates submit a rank-order list (ROL) of their preferred programs, residency program directors submit a ROL list of preferred candidates, and the matching algorithm produces a best result. Successful candidates are contractually obligated to accept the resulting placement. Candidates who are unsuccessful in being matched must "scramble" in competition with others for the few positions remaining after the Match results are announced.

The process of seeking a residency position is stressful for all candidates, but it is especially so for international medical graduates (IMGs). Before they are eligible to participate in a residency in the United States, IMGs must pass Step 1 (Basic Science) and Step 2 (Clinical Knowledge and Clinical Skills) of the same United States Medical Licensing Examination (USMLE) required of U.S. graduates, and they must have their

credentials verified by the Educational Commission for Foreign Medical Graduates (ECFMG). The pass rate in 2008 for first-time IMG takers of Step 1 was only 73%; for Step 2 Clinical Knowledge it was 81%, and for Step 2 Clinical Skills it was 72%. Many who fail on the first try continue taking the examinations, and some eventually pass.²

In the competition for available residency positions, IMGs have a more difficult time because they typically have lower scores on the USMLE, may be graduates of schools unfamiliar to residency program directors, may have problems with visa requirements, and may have to travel much longer distances to interview sites. Even IMGs who are U.S. citizens, many of whom have completed clerkship rotations in the United States, face some of those hurdles. In fact, U.S.-citizen IMGs have lower pass rates on Step 1 and Step 2 Clinical Knowledge than do IMGs who are not U.S. citizens.^{2,3} Nevertheless, given the array of factors that come into play in the selection process, U.S.-citizen IMGs, as a group, are still more likely to eventually obtain graduate training positions.⁴

Despite the difficulties they encounter, many IMGs have been capable students,

Dr. Jolly is senior director, Special Studies, Association of American Medical Colleges, Washington, DC.

Dr. Boulet is associate vice president, Research and Data Resources, Foundation for Advancement of International Medical Education, Philadelphia, Pennsylvania.

Dr. Garrison is director, Student and Applicant Studies, Association of American Medical Colleges, Washington, DC.

Ms. Signer is executive director, National Resident Matching Program, Washington, DC.

Correspondence should be addressed to Dr. Jolly, Association of American Medical Colleges, 2450 N St., NW, Washington, DC 20037-1127; telephone: (202) 828-0257; e-mail: pjolly@aamc.org.

Acad Med. 2011;86:559-564.

First published online March 23, 2011

doi: 10.1097/ACM.0b013e318212de4d

make competent residents,⁵ perform well as physicians,^{6,7} and help to diversify the physician workforce.⁸ They are an important component of the U.S. system of medical care. They make up 23.5% of practicing physicians⁹ and 27.6% of residents,¹⁰ but constitute 47.1% of ERAS applicants¹¹ and 43.8% of NRMP participants.¹² The disproportionate numbers of applicants in relation to practicing physicians reflects not only the failure of many IMGs to find a position but also the fact that many IMGs repeat their efforts in one or more additional years.

Although the fact that IMGs apply in more than one year has been known for some time, and although the ECFMG, the NRMP, and the American Medical Association publish data for single years in annual statistical reports,^{2,12,13} there have been no longitudinal studies demonstrating the ultimate success of IMGs in finding residency positions. That is the subject of the present report.

Method

This work is a joint effort of the AAMC, the NRMP, and the ECFMG. The study was proposed by the ECFMG and endorsed by the NRMP Data Release and Research Committee and the AAMC leadership. In May 2009, a comprehensive reciprocal licensing agreement, signed by all three organizations, provided for the study of a cohort of 10,328 IMGs who were certified by the ECFMG between July 1, 2005 and June 30, 2006.

The ECFMG created a file containing attributes of all IMGs certified in 2005–2006 and shared it with the AAMC and the NRMP. The AAMC and the NRMP matched the file to their records, created extracts describing NRMP and ERAS activity for the same individuals, and then linked the data to those of new residents in GMETTrack, a system containing residency records from the National GME Census.¹⁰ Several distinct tables were created because of the one-to-many relationships; namely, some individuals applied more than once in ERAS, and some registered more than once with the NRMP. The collection of records applying to an individual can be complex, reflecting repeated unsuccessful and often eventually successful application activity by each person.

To simplify the analysis, each person was followed only until the first entry into a U.S. graduate medical education (GME) program. Subsequent residency positions were ignored for this work.

The data available for this study included those regarding NRMP and ERAS activity through the 2008–2009 application year and residency activity through the first half of 2010. The records from ERAS and the NRMP are complete; AAMC staff estimate that the GMETTrack records are at least 95% complete. Because a small percentage of residents are missing from GMETTrack, numbers of IMGs in residency positions may be slightly underestimated.

Data have been carefully scrubbed to eliminate any duplicate records. Because we are dealing with population statistics, measures of statistical significance are not appropriate.

In some cases, the records show residency activity prior to ECFMG certification. Although such a path should be impossible, there may be extraordinary circumstances where it may have been permitted, or it may have resulted from erroneous reports. We have included data on the few examples of residencies begun in 2003 and 2004, but it would not be expected that graduates certified in 2005 would be able to find a residency earlier than 2005, and in most cases they would not be able to do so until 2006 or later, because of practical considerations involving the time required for making applications.

The study protocol was approved by the institutional review board of the American Institutes for Research.

Results and Discussion

Characteristics of the IMGs

IMGs come from all over the globe. The cohort included citizens of 143 countries or territories who received medical degrees in 135 different countries or territories. Of the 10,328 IMGs in the cohort, 1,823 were U.S. citizens at the time they began their medical education (US IMGs); they studied in 69 different countries or territories. Table 1 includes the numbers of all IMGs and of US IMGs from the top 20 countries that provided the IMGs' medical education, which account for 69% of the IMGs certified by

the ECFMG in 2005–2006. India and Pakistan account for the greatest numbers of IMGs, but US IMGs train predominantly in the Caribbean schools. Schools in Dominica, Grenada, and the Netherlands Antilles account for 55% of US IMGs. In Table 1, the column labeled "Citizens" under the "All IMGs" category reports the numbers of citizens of each country who graduated from any international medical school.

Table 1 also shows the numbers of US IMGs and non-US IMGs who participated in ERAS or the NRMP at any time during the study period and the number who ultimately obtained a residency position. Ninety-one percent of US IMGs were successful, but only 73% of non-US IMGs were.

Seventy-six percent of IMGs indicated a native language other than English, but 75% received at least some of their instruction in English. The cohort was 58% men, and the IMGs were considerably older when they first applied for a residency position than are most U.S. medical graduates. The mean age when the ECFMG certificate was issued was 31.3 years, with a standard deviation of 5.6 years. There often was an interval of one or more years between medical school graduation and certification, and, as we show in the sections that follow, there often was an interval of several years after being certified before an IMG began a U.S. residency. Table 2 reports these statistics separately for US IMGs and non-US IMGs.

Participation in ERAS

Senior medical students in U.S. MD- or DO-granting institutions register with ERAS through the dean's office of their medical school. Ordinarily, registration is permitted only for students who are expected to graduate in the year residency training is to begin. In unusual circumstances, a student might apply to residency programs through ERAS but not graduate on time or perhaps not graduate at all. Students who have graduated in a prior year but who still wish to make a residency application nevertheless must register through the dean's office of the school from which they graduated.

International medical students and graduates register for ERAS through the ECFMG, which first determines whether

Table 1

Citizenship Countries and International Medical School Countries for International Medical Graduates (IMGs) Certified by the Educational Commission for Foreign Medical Graduates (ECFMG) in 2005–2006*

Country	Number of all IMGs		Number of US IMGs [†]				Number of non-US IMGs			
	Citizens	Graduates	Graduates	In ERAS	In the NRMP	In the GMETTrack	Graduates	In ERAS	In the NRMP	In the GMETTrack
India	2,404	2,414	80	78	76	72	2,334	2,237	2,170	1,844
Pakistan	544	604	41	41	37	36	563	548	535	402
Dominica	6	434	360	357	349	342	74	73	73	65
China	412	412	1	1	0	1	411	402	394	300
Grenada	1	410	332	328	321	322	78	75	71	68
Netherlands Antilles	0	399	313	307	299	290	86	85	83	78
Philippines	320	381	45	45	44	35	336	322	314	257
Nigeria	246	242	11	11	10	10	231	224	219	171
Colombia	179	183	10	10	10	8	173	160	155	136
Dominican Republic	72	174	74	69	67	63	100	99	93	85
Iran	192	171	5	5	5	5	166	162	160	126
Romania	153	168	2	2	2	2	166	159	143	135
Egypt	149	158	6	6	6	6	152	147	142	93
Mexico	94	157	49	32	34	47	108	93	95	78
Russia	99	155	2	2	2	1	153	141	135	102
Germany	119	145	8	5	5	5	137	92	90	80
Lebanon	142	141	10	10	10	10	131	124	113	109
Israel	94	141	58	55	54	55	83	25	25	32
Ireland	51	140	52	49	49	45	88	46	43	42
South Korea	0	138	3	3	2	3	135	74	72	45
All other countries	5,051	3,161	361	337	335	305	2,800	2,362	2,273	1,950
Total	10,328	10,328	1,823	1,753	1,717	1,663	8,505	7,650	7,398	6,198

* A total of 10,328 IMGs were certified by the ECFMG in 2005–2006.

[†] "US IMGs" were citizens of the United States at the time they began their medical education. Source: ECFMG, National Resident Matching Program (NRMP), and the GMETTrack database of the Association of American Medical Colleges. (Note: ERAS indicates Electronic Residency Application Service.)

they are likely to complete the requirements for ECFMG certification in time to begin a residency in the year for which they are applying. It is often the case, however, that an international medical student or graduate will participate in ERAS but fail to complete all of the requirements in time to start a residency.

ERAS transmits a common application, transcripts, deans' letters, letters of recommendation, USMLE scores, and ECFMG certifications to residency programs. It is up to the residency programs to verify the completeness of those credentials before offering a residency position.

Table 3 displays ERAS activity for the cohort of international medical students

and graduates who were certified in academic year 2005–2006. Note that in a number of cases, students participated in ERAS before being certified by ECFMG. In 31 cases, applicants seemed to have started a residency program more than a year before ECFMG certification. Those may be exceptional situations or represent reporting errors.

In an additional 150 cases, applicants started a residency in the same year in which they were certified by the ECFMG. All members of our study cohort were certified on or after July 1, 2005, the same date on which new residents normally begin their appointments, which indicates that they may have started a residency before being certified. In many of those cases, however, the reported starting date for the residency was a few

days after an early July certification date. In other cases, it is possible that residency programs reported a nominal starting date of July 1, 2005, when the actual starting date was a few days later. There are nevertheless some additional cases where graduates were reported to have started a residency more than a few days before being certified.

In ERAS 2005, there were 1,006 IMG applicants from the study cohort, but only 99 were successful, because most of them were not certified in time to begin a residency program at the normal start date. An additional 51 managed to start a residency without applying through ERAS.

ERAS 2006 was the first year in which most of the newly certified IMGs could

Table 2

Characteristics of International Medical Graduates (IMGs) Certified by the Educational Commission for Foreign Medical Graduates (ECFMG), 2005–2006*

Characteristic	Number of US IMGs	Number of non-US IMGs
Sex		
Male	1,102	4,862
Female	721	3,643
Native language		
English	1,410	1,122
Not English	412	7,381
Unknown	1	2
Language of instruction		
English	1,705	6,064
Not English	118	2,441
Age at certification		
Minimum	23	23
Maximum	64	65
Average	30.7	31.4
Standard deviation	5.3	5.6

* A total of 10,328 IMGs were certified by the ECFMG in 2005–2006.

† “US IMGs” were citizens of the United States at the time they began their medical education. Source: ECFMG.

have applied for residency. The majority did apply through ERAS in that year, and 4,601 were successful. Of the 2,283 who did not apply through ERAS, 139 nevertheless gained entry to a residency program.

Some members of the cohort may have delayed their applications because of practical considerations, such as the need to obtain a visa or make travel

arrangements. Many of those individuals, as well as others who were unsuccessful in 2006, applied again in ERAS 2007. In that year there were 3,967 IMG participants, more than half of whom were successful. As in previous years, a substantial number found positions without using ERAS.

IMGs who were certified in 2005–2006 continued to apply through ERAS in

2008 and 2009, though in diminishing numbers. Applications from this cohort will surely be seen in the data for ERAS 2010 and ERAS 2011 as well. In all, 76% of IMGs in the study cohort had obtained a residency position before July 1, 2009, and it is likely that a few more will be successful in the years to come.

Participation in the NRMP

IMGs may register with the NRMP without being certified by the ECFMG, but they are withdrawn from the Match by the NRMP if they have not passed the ECFMG examination requirements by the deadline for submitting an ROL. IMGs may withdraw themselves from the Match if they find a position outside the Match or for any other reason. If they wish to continue, they must certify an ROL of preferred programs before the Match deadline.

Some residency programs do not participate in the NRMP, and even those that do participate are permitted by their agreement with the NRMP to accept IMGs before the Match. An applicant obtaining such a position ordinarily would withdraw from the Match. Details in the NRMP Match Participation Agreement are available on the NRMP Web site.

Even if they do not withdraw, many IMGs do not certify an ROL. If they have been unsuccessful in obtaining any interviews, there is little point in participating in the Match because no program would be expected to rank such candidates.

A total of 9,115 members of the cohort had registered with the NRMP through the 2009 Match year. The 1,213 who did not register either sought a position outside the Match or did not seek a GME position in the United States.

Participation by the cohort in the NRMP by Match year is shown in Table 4. New applicants are those who had never before registered with the NRMP; repeat applicants had registered in at least one prior year. The number who successfully matched in each group is also shown. In recent years, less than half of IMG candidates who certified an ROL successfully matched.¹²

A small number of candidates registered with the NRMP for the 2003 and 2004 Main Residency Matches even before

Table 3

Participation of International Medical Students and Graduates in the Electronic Residency Application Service (ERAS) and Entry Into Graduate Medical Education (GME)*

ERAS and GME year	Number with prior GME	Number who entered GME	In ERAS		Not in ERAS	
			Total number	Number who entered GME	Total number	Number who entered GME
Pre-2003	10,328	19	—	—	—	—
2003	10,309	6	55	0	10,254	6
2004	10,303	6	171	3	10,132	3
2005	10,297	150	1,006	99	9,291	51
2006	10,147	4,740	7,864	4,601	2,283	139
2007	5,407	2,193	3,967	2,038	1,440	155
2008	3,214	543	1,563	470	1,651	73
2009	2,671	204	841	155	1,830	49

* Table 3 displays ERAS activity for the 10,328 students and graduates who were certified by the Educational Commission for Foreign Medical Graduates (ECFMG) in academic year 2005–2006. ERAS data were not available for the pre-2003 years. Note that in a number of cases, students participated in ERAS before being certified by the ECFMG. In 31 cases, applicants seemed to have started a residency program more than a year before ECFMG certification. Those may be exceptional situations or represent reporting errors. Source: AAMC Data Warehouse, 2010.

Table 4

Participation of International Medical Graduates (IMGs) in the National Resident Matching Program (NRMP), 2003–2009*

Year	Number of graduates registered, with certified rank-order list (ROL), and matched										
	No prior GME	Entered GME	New applicants [†]			Repeat applicants [†]			Total applicants		
			Registered	With ROL	Matched	Registered	With ROL	Matched	Registered	With ROL	Matched
2003	10,309	6	47	0	0	9	0	0	56	0	0
2004	10,303	6	145	3	1	19	1	0	164	4	1
2005	10,297	150	817	99	34	85	15	4	902	114	38
2006	10,147	4,740	6,681	4,483	2,605	775	571	232	7,456	5,054	2,837
2007	5,407	2,193	1,190	853	421	2,341	1,743	755	3,531	2,596	1,176
2008	3,214	543	107	69	32	1,188	865	261	1,295	934	293
2009	2,671	204	37	27	10	604	426	92	641	453	102

* A total of 10,328 IMGs were certified by the Educational Commission for Foreign Medical Graduates in 2005–2006.

[†] New applicants are those who had never before registered with the NRMP; repeat applicants had registered in at least one prior year. Source: NRMP Data Warehouse, 2010.

they were certified. As required by the rules, NRMP records show that all but four of those applicants were withdrawn. The single case of an applicant who matched in 2004 before being certified should not have been possible and may be an error. Most applicants certified in 2005 would have been unable to register for the 2005 Match, but 902 managed to do so, including 85 who had registered in an earlier year. Most of the 904 did not certify an ROL, but 114 did, and 38 actually matched to a residency program open to applicants without prior GME (a first-year residency program).

Almost three-fourths (73%) of those who registered with the NRMP did so for the first time in 2006, the first year when all would have been eligible to participate. It is noteworthy, however, that a substantial percentage (13%) did not register until 2007, and some continued to add their registrations to the system in 2008 and 2009.

In 2007, the second Match year available to all members of the cohort, there were almost twice as many repeat applicants as first-time applicants. Repeat applicants continued to register in 2008 and 2009,

and it is likely that even more will be found in the next year's pool of applicants. As a group, IMGs are very persistent in seeking a U.S. GME position.

Pathways into GME for IMGs

Table 5 displays the participation in ERAS, the NRMP, and GME by the study cohort's IMGs, who were certified in 2005–2006. The data for each year include only candidates who had not yet entered GME at the beginning of that year. The numbers in parentheses are the new residents each year from each group of candidates.

If an applicant has not met the ECFMG examination requirements by the NRMP deadline for certifying an ROL, the applicant is withdrawn from the Match by the NRMP. There is nothing to prevent such a person from registering with ERAS and the NRMP, however, and it might make sense for a person who expected to be certified in time to start a residency to do so in anticipation of that eligibility. Although it is possible for a person certified in 2005 to participate in ERAS and even to register for the NRMP in 2005, most of those candidates first registered with ERAS and the NRMP in 2006. Table 5 shows a few anomalous cases where applicants who may have been ineligible to begin a residency nevertheless participated in ERAS and NRMP. Most of those anomalous applicants did not find a residency; those who did likely found a position outside of the NRMP.

Table 5

Participation in ERAS, the NRMP, and GME by International Medical Graduates (IMGs) Certified by the ECFMG in 2005–2006*

Year	Number of participants (number of new residents)				
	Total	Neither ERAS nor NRMP	ERAS only	ERAS and NRMP	NRMP only
2003	10,309 (6)	10,244 (6)	9 (0)	46 (0)	10 (0)
2004	10,303 (6)	10,086 (3)	53 (0)	118 (3)	46 (0)
2005	10,297 (150)	9,187 (46)	208 (8)	798 (91)	104 (5)
2006	10,147 (4,740)	2,191 (128)	500 (205)	7,364 (4,396)	92 (11)
2007	5,407 (2,193)	1,425 (151)	451 (212)	3,516 (1,826)	15 (4)
2008	3,214 (543)	1,635 (72)	284 (57)	1,279 (413)	16 (1)
2009	2,671 (204)	1,812 (49)	218 (23)	623 (132)	18 (0)

* A total of 10,328 IMGs were certified by the Educational Commission for Foreign Medical Graduates in 2005–2006. The data for each year include only candidates who had not yet entered GME at the beginning of that year. The table shows a few anomalous cases where applicants who may have been ineligible to begin a residency nevertheless participated in ERAS and the NRMP. Most of those anomalous applicants did not find a residency; those who did likely found a position outside of the NRMP. ERAS indicates Electronic Residency Application Service; NRMP, National Residency Matching Program; GME, graduate medical education; ECFMG, Educational Commission for Foreign Medical Graduates (ECFMG). Source: AAMC Data Warehouse and NRMP Data Warehouse, 2010.

For 2006, the first year in which most candidates were eligible to participate in ERAS and the NRMP, there were 10,147 candidates without a residency position at the beginning of the academic year. The majority (73%) participated in both ERAS and the NRMP. Of the 10,147 candidates, 2,191 participated in neither ERAS nor the NRMP, but 128 of those applicants nevertheless started a residency. Those few may have taken advantage of a personal relationship, perhaps at the hospitals where they participated in clerkships.

A total of 500 candidates participated in ERAS but not in the NRMP, and 205 were successful in starting a residency. An even smaller number participated only in the NRMP, and 11 were successful in finding a residency.

Most of the graduates still without a residency in 2006, a total of 7,364, participated in both ERAS and the NRMP. Although only 2,729 of these dual participants actually matched, an additional 1,667 found a position outside of the Match, with the result that a total of 4,396 were successful.

Of the entire 10,147 graduates without a residency in 2006, 5,407 (53%) failed to find a residency position in that year. Many applied again in 2007 and subsequent years, but with each passing year the success rate of the remaining graduates declined. Of those who remained in 2007, 41% were successful; in 2008 only 17% of those remaining were successful. After the close of the 2009 cycle, 76% of the original cohort had obtained residency positions, and it is likely that a few more will be successful in years to come.

Conclusions

IMGs are persistent in their pursuit of GME positions. They usually take advantage of ERAS and participate in the

NRMP. If unsuccessful, they try again, often multiple times. Eventually, more than three-fourths of this study cohort successfully entered U.S. GME. Nonetheless, NRMP data demonstrate the declining success rate of IMGs in the Match. Between the 2005 and 2009 Matches, the percentage of IMGs who certified ROLs and matched to first-year residency positions fell from 54.7% to 47.8% for U.S. citizens and from 55.6% to 41.6% for non-U.S. citizens.¹² Because enrollment in U.S. MD-granting and DO-granting medical schools is increasing much more rapidly than the number of entry-level residency positions,^{10,14} competition for residency positions will intensify, especially for IMGs.

In a subsequent work, we will compare the characteristics of successful and unsuccessful IMG candidates, including examination performance, and further elucidate the differences between US IMGs and non-US IMGs. Given the contribution of IMGs to the U.S. physician patient care workforce, the data provided in the current report, combined with the results from additional past and future longitudinal investigations, can inform relevant physician workforce policies and help organizations involved with the certification, selection, and education of IMGs to better plan for future activities.

Funding/Support: None.

Other disclosures: None.

Ethical approval: The study protocol was approved by the institutional review board of the American Institutes for Research.

References

- 1 Association of American Medical Colleges ERAS (Electronic Residency Application Service). <http://www.aamc.org/eras>. Accessed January 27, 2011.
- 2 Educational Commission for Foreign Medical Graduates. 2008 Annual Report. Philadelphia, Pa: Educational Commission for Foreign Medical Graduates; 2009.
- 3 Boulet J, Swanson DB, Cooper RA, Norcini JJ, McKinley DW. A comparison of the characteristics and examination performances of U.S. and non-U.S. citizen international medical graduates who sought Educational Commission for Foreign Medical Graduates certification: 1995–2004. *Acad Med.* 2006; 81(10 suppl):S116–S119. http://journals.lww.com/academicmedicine/Fulltext/2006/10001/A_Comparison_of_the_Characteristics_and.29.aspx. Accessed January 27, 2011.
- 4 Boulet J, Norcini JJ, Whelan GP, Hallock JA, Seeling SS. The international medical graduate pipeline; recent trends in ECFMG certification and residency training. *Health Aff (Millwood).* 2006;25:469–477.
- 5 van Zanten M, Boulet J, McKinley D, Whelan GP. Attrition rates of residents in postgraduate training programs. *Teach Learn Med.* 2002;14:173–175.
- 6 Norcini J, Boulet J, Whelan G, McKinley D. Specialty board certification among U.S. citizen and non-U.S. citizen graduates of international medical schools. *Acad Med.* 2005;80(10 suppl):S42–S45. http://journals.lww.com/academicmedicine/Fulltext/2005/10001/Specialty_Board_Certification_among_U_S_Citizen.14.aspx. Accessed January 27, 2011.
- 7 Norcini JJ, Boulet JR, Dauphinee WD, Opalek A, Krantz ID, Anderson ST. Evaluating the quality of care provided by graduates of international medical schools. *Health Aff (Millwood).* 2010;29:1461–1468.
- 8 Norcini J, van Zanten M, Boulet J. The contribution of international medical graduates to diversity in the U.S. physician workforce: Graduate medical education. *J Health Care Poor Underserved.* 2008;19:493–499.
- 9 AMA Physician Masterfile [database]. Chicago, Ill: American Medical Association; 2009. Used by permission.
- 10 GMETrack [database]. Washington, DC: Association of American Medical Colleges; 2008.
- 11 Electronic Residency Application Service [database]. Washington, DC: Association of American Medical Colleges; 2009.
- 12 Results and Data/2009 Main Residency Match. Washington, DC: National Resident Matching Program; April 2009.
- 13 Brotherton SE, Etzel S. Graduate medical education 2009–2010. *JAMA.* 2010;304:1255–1270.
- 14 Association of American Medical Colleges. Medical School Enrollment Plans Through 2014: Analysis of the 2009 AAMC Survey. <http://www.aamc.org/initiatives/workforce/reports>. Accessed January 27, 2011.